Volume 62

American Machinist

Number 2

New York, January 8, 1925

Methods in a Fire-Engine Shop

By Fred H. Colvin
Editor, *American Machinist*

Tools, fixtures and methods used in building a high-grade product economically in small quantities—Testing steel for gears—Shrinking starter ring gears — Worm-controlled engine stand

ONE would hardly compare motors for fire apparatus with those for airplanes, and yet in both cases, reliability is of first importance. The airplane motor must be thoroughly reliable and capable of hours of service at maximum speed. But the number of hours that an airplane motor must run is small indeed as compared with that of the modern motor driven pump for fire purposes. The motors of the ZR-3 were in operation only about 80 hours.

There are numerous instances of fire-pump motors being run for 200 to 300 hr. without a stop, pouring tons of water into the ruins caused by some disastrous fire. The greatest difference is in the weight per horsepower of the motors, the fire-pump motor being much heavier. Bearing in mind the necessity for long periods of service, it is not strange to find progressive builders of modern fire apparatus always on the lookout for materials that will prove more reliable and give continued service with the minimum of attention and without failure. As an example of this search, the tests being carried on by the Ahrens-Fox Fire Engine Co., Cincinnati, Ohio, for better materials for gears, are of interest.

In order to know which steel will stand the most shock when used in gears for various parts of fire apparatus, the superintendent, Wm. H. Shafer, has rigged up the drop test machine shown in Fig. 1. This consists of a suitable upright that serves as a guide for the falling weight and is graduated so as to give any predetermined drop, up to 8 ft. The weight of the head is 30 pounds.

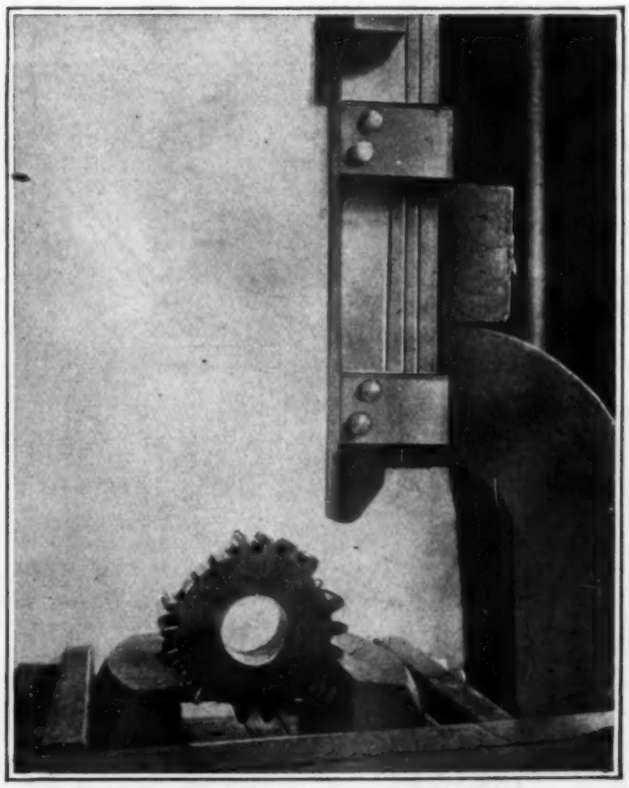


Fig. 1—Drop test for gear teeth in use at the Ahrens-Fox plant

A large number of gears have been made from a variety of alloy steels, each gear being heat-treated by the steel-maker's representative or according to the maker's directions. The gears are then placed in the machine as shown in Fig. 1 and several teeth tested to destruction. Other methods of holding the gears being tested are under consideration, and the results of the various tests are being carefully tabulated in the belief that they will give much useful information. The same care as to the materials extends to all parts of the apparatus, for both lives and property depend on it.

The problems of manufacturing high-grade, duplicate machinery in small quantities are much the same here as in hundreds of other plants. Many of the parts must be made in fixtures to secure interchangeability and economy in assembly, even though the quantity be small. And the cost of these fixtures cannot be spread over a large output as with the automobile built in quantities. Consequently fixtures must be carefully designed with an eye to first cost as well as to the production obtained and the quality of work secured.

The crankcase or engine base, as it might well be called on account of its size, is now being made of a heat-treated aluminum-alloy casting that gives increased strength and stiffness. This material affects the machining qualities so that a reduced cutting speed has become necessary. The cylinders are cast singly and bored in pairs, in a special Moline "hole-hog." The fixtures are shown in Fig. 2. The bottom flange of the cylinder is first faced by milling and the four bolt holes

AUTOMOTIVE PRODUCTION

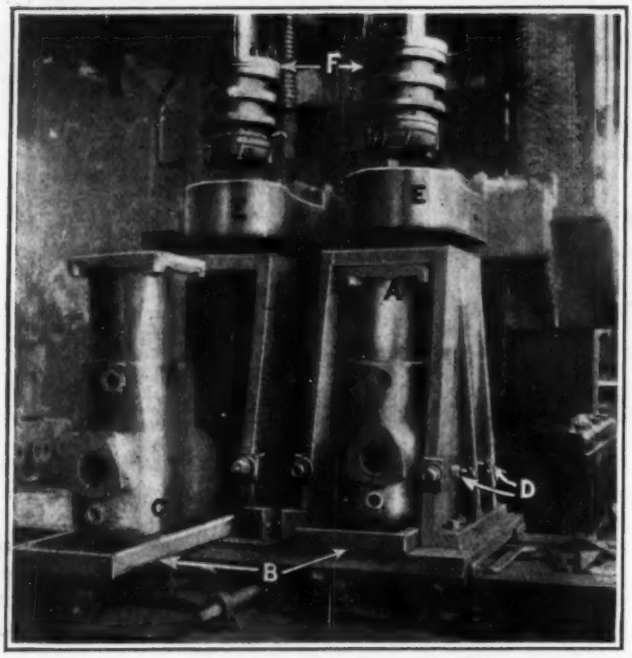


Fig. 2—Fixtures for cylinder boring

drilled and reamed, the holes being used in holding the flanged end in proper position against the top plate of the fixture as at *A*. The slides *B* make it easy to handle the cylinders in and out of the fixtures. The cylinders are placed on the slides as at *C*, then pushed into the fixtures and bolted in place, the bottoms being steadied by setscrew as at *D*.

Above the fixtures are heavy guides *E*. They are bored much larger than the cylinders to receive the bushings on the boring spindles. A dowel pin in the top of each stationary guide engages a hole in the upper flange of the bushings *F*, and prevents rotation. Inside these bushings, however, are bronze sleeves splined to the boring spindles and which revolve with them in the bushings.

The result of this combination is to protect the boring spindles from the wear due to revolving inside the guides, by taking the wear on the bronze sleeves surrounding the spindles. The only spindle wear is due

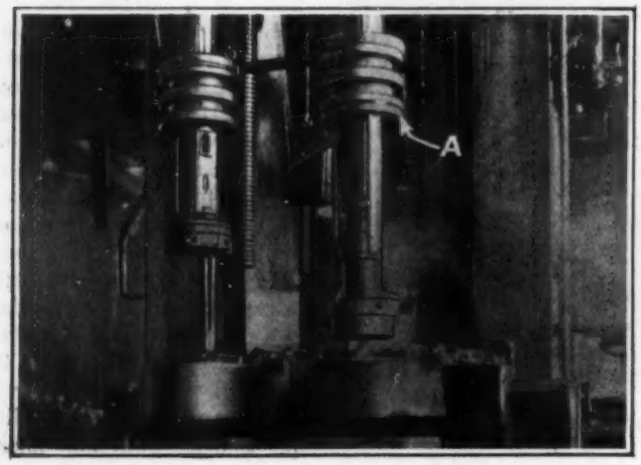


Fig. 3—Counterboring tool in place

to the end movement through the bronze sleeves, as the spindle is fed down into the cylinder, and has proved to be negligible. In Fig. 2, the boring-cutter heads may be seen in the spindles.

The cylinders have closed ends and expanding-cutter heads are used to machine the counterbore, beyond the piston travel. The cutter heads are shown in the ma-

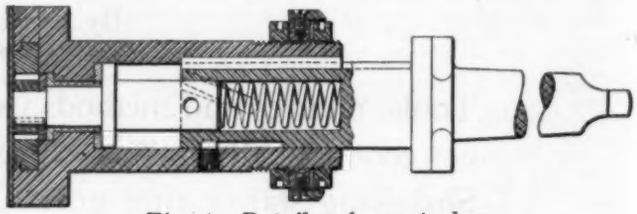


Fig. 4—Details of counterbore

chine in Fig. 3. They fit the spindles the same as boring heads and carry collars as at *A* which go through the fixed guides and seat against the bottom flanges of the cylinders. The cutters are normally held below the diameter of the cylinder bore but after the collar reaches the cylinder, further downward movement forces the cutters outward and machines the counterbore. In Fig. 4, the details of the construction are shown.

There are many other interesting tools and fixtures—an indexing table in which the index is protected from dirt and chips, as shown in Fig. 5. It is simply a well

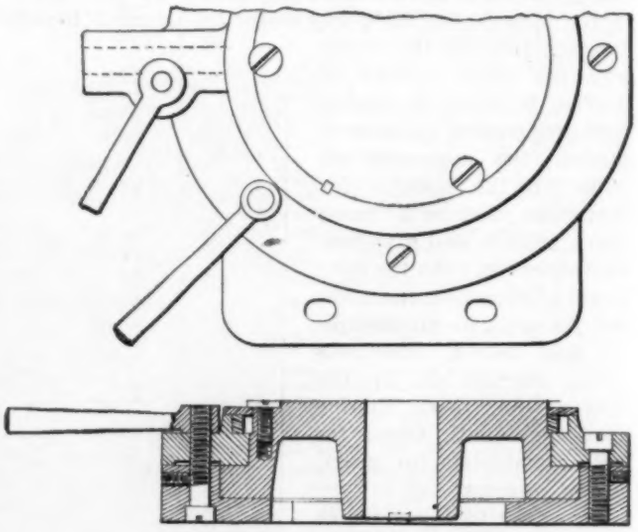


Fig. 5—A protected index plate

designed indexing table with the index plate in a recess so that a cover plate can be used over it.

For shrinking the ring gear on the flywheel for the self starter, a very simple heating device is used. It consists of a ring made of ordinary pipe bent into a circle of the right diameter as at *A*, Fig. 6, and drilled on the upper side with a suitable number of small holes. The connections for gas, however, are a bit unusual as shown in Fig. 7. The ends of the pipe are fitted with ball-seat couplings which are readily attached by hand to the outlets. One pipe is for gas and the other for air, so that by manipulating the valves *B* and *C*, Fig. 6, it is possible to secure just the mixture desired for the

AUTOMOTIVE PRODUCTION

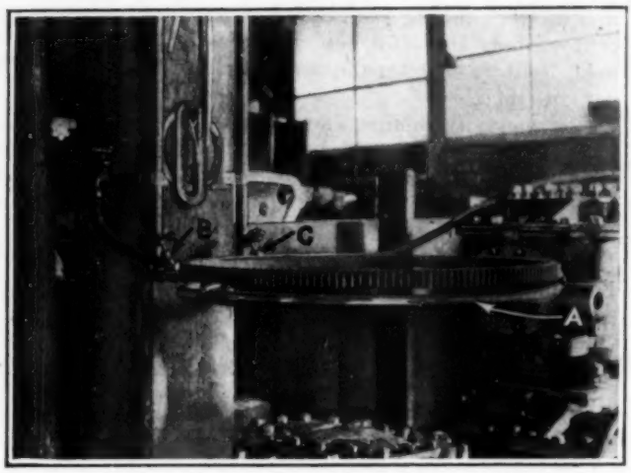


Fig. 6—Heating starter ring for shrinking

hottest flame. When the ring gear is heated sufficiently it is placed on the flywheel and allowed to cool, a shoulder on the flywheel insuring the ring going in square and to the proper position.

Fig. 7—Diagram of heating ring

Every engine is thoroughly tested both before and after mounting in the chassis. The testing stand consists of a heavy bed plate and a large electric motor which can also be run as a generator. When a new engine is placed on the test stand it is run by the electric motor for a given period and then run under its own power with the generator as a load. Occasionally it is found desirable to inspect or adjust bearings, and so the roll-over stand shown in Fig. 8 is provided although seldom used. The form of stand is not unusual but, on account of the weight of the engine, the worm-driven chain control was added. A crank on the shaft *A* operates the worm and worm wheel. Behind it is the small sprocket for the chain which turns the roll-over frame on its rollers, making it very easy to turn the engine to any desired position.

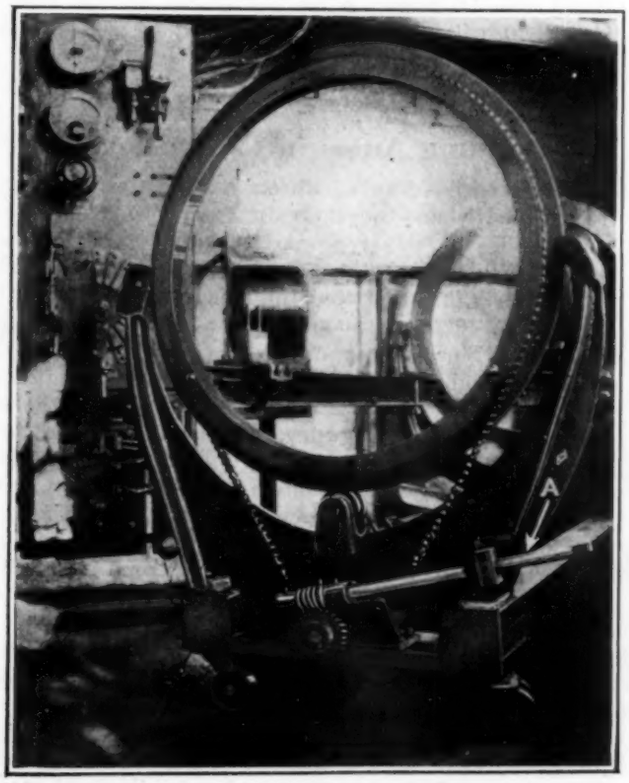


Fig. 8—Worm-driven roll-over frame

Abstracts

from other publications

Quality Manufacturing At Predetermined Costs

E. F. Roberts, vice-president of manufacturing of the Packard Motor Car Co., introduces a new thought into factory operations particularly with reference to establishing standard costs just as standard operations are established. Each part of a car has to be made in accordance with dimensions standardized on the blueprints by the designing engineer, and, similarly, the Packard company is standardizing the cost of every part by its accounting department before hand. This has been found to be less complicated and less expensive than the old way of governing by cost records.

Just as in manufacturing to tolerances, the costs are placed with tolerances to allow for the influence of changes in market price of materials or even in wages. The payment method is previously described as a bonus system, but if the company had regarded the bonus merely as a means of getting more work out of the men, it never would have been adopted. When the new system was put into operation 95 per cent of the force had been with the company over five years, and every man on it was doing the best day's work he knew how to do, driven by what is possibly the greatest of all incentives—the desire to hold his job at a time when jobs were scarce.

Advantages of this system are that it has enabled them to sustain standards of quality and given them a cheap cost accounting system. The payment system is a foundation for a positive, constructive control over production problems. It saves a tremendous sum in the control of materials. It has also helped the morale of the factory. The three other methods of payment have been tried—day-rate, piece-work and the Rowan premium system—but none was as satisfactory as the present method that may be described as a group bonus. Men were organized into groups of 50 or 60 workers. In some of the groups one man's work is relative to anothers. In others the work is strictly individual. The payment, of course, is based on time-study and this includes no allowances whatever.

"Had we permitted our time-study men to exercise their own judgment in making allowances for the various factors that may retard a worker's production, we should have had as many kinds of standards as we had

AUTOMOTIVE PRODUCTION

time-study men," Mr. Roberts explains. "This we were not willing to permit, for a fundamental idea of our present system is that it is based on a single, uniform standard. That is to say, on a standard that is as nearly uniform as we find it possible to make.

"Through the studies we have made of the time required to do the operations in this department, we have been able to set certain time standards. We know that if everyone works at an average rate throughout the day he will produce a certain amount of work.

"We realize that it will not be possible for him to work continuously at the standard rate. There will be an occasional machine breakdown, delays in materials needed, time spent in getting instruction, time for changing tools, and so on. But these hindrances ought not to reduce production more than approximately 20 per cent.

"Therefore, if the men work steadily at a rate of speed that they have shown they can maintain, but with ordinary delays, the production will be at least 80 per cent of what it would be if they maintained the standard rate of progress without any delay. If they produce more than 80 per cent of the standard in any period we will add to their wages for the period. If they produce 81 per cent, which is 1 per cent more than the minimum for the department, they will find 1 per cent added to the amount that is usually in their pay envelope. If their production is 85 per cent they will earn a 5 per cent bonus. If it is 100 per cent the additional earnings will be 20 per cent, or one-fifth of the regular pay check."—*Factory*, October, p. 495.

Metals Used in Airplanes

J. B. Johnson, chief of the materials section of the Air Service, Engineering Division, McCook Field, Dayton, writes that the most radical developments in all-metal airplanes are the types in which both the fuselage and the wings have been built entirely of metal. In practically all of the designs the metal used for the wings is a heat treated aluminum alloy that develops a minimum tensile strength of 55,000 lb. per sq.in. Wing beams and ribs are formed from the sheet metal and rolled into shapes, such as angles, channels and corrugated strips. These are riveted together with aluminum alloy rivets. The parts are then assembled into the wing structure and covered with a thin corrugated sheet of the same metal. The riveting operation is slow and costly, as many thousands of small rivets must be driven in places that are almost inaccessible. The fuselage is built up of aluminum alloy tubes or steel tubes.

The material in the steel tubes is a low-carbon steel with a range of from 0.10 to 0.25 per cent carbon. The vertical members are welded to the horizontal members at the junction points by means of an oxy-acetylene welding torch. Due to the danger of warping the structure, no attempt is made to anneal the welds. The tension members of the truss are made of cold-rolled carbon steel wire of approximately 0.45 per cent carbon that has been heat treated and cold rolled to an elliptical section and which is known to aircraft engineers as streamline wire.

The bent axles for the landing gear are made of a nickel steel tubing containing approximately 0.30 per cent carbon and 3.50 per cent nickel. This tubing is heat treated to a tensile strength of about 175,000 lb. per sq. inch.

Chrome-molybdenum alloy steel tubing is now being used in one experimental design for the structural members of the fuselage. It has been found that tubing of this analysis welds satisfactorily. The tubing has a minimum tensile strength of 95,000 lb. per sq. inch.

There is little doubt that the future airplane will be built entirely of metal on account of its uniformity and permanency. The structure will probably be a combination of alloy steel and heat treated aluminum alloy, developed on the basis of the lightest weight for maximum strength and stiffness.—*The Iron Age*, Oct. 16, p. 994.

Regrinding Automobile Cylinders

The typical equipment of a small shop consists first of a cylinder grinder fitted with an angle-iron jig for the ready mounting of different types of cylinder blocks. Intimately associated with cylinder grinding is the grinding of over-size pistons to fit the refinished cylinders. Two machines usually are required to take care of this work, a lathe for taking roughing cuts and bringing the oversize piston to the approximate size and a cylindrical grinder for taking the finishing cut.

The finishing of pistons and cylinders is precision work and for this reason new equipment should be purchased rather than used tools. The typical equipment for the shop using one cylinder grinder will cost about $4,000 in the present market. The wheel on a cylinder grinder must be dressed frequently and its average life is not over 50 holes. A black diamond dresser, costing about $20, will last approximately 12 months.—*Abrasive Industry*, January, p. 9.

Building Autos in Czechoslovakia

The Skoda Works at Pilsen has obtained a license from the Hispano-Suiza Co. in France to manufacture automobiles of this type at the works in Pilsen, and steps are already being taken to start manufacturing immediately, in order that the Czech car may be on the market in 1925. It is understood that the agreement with the French firm gives the Skoda Works the exclusive sales rights not only in Czechoslovakia, but in most of the countries in Central Europe, including Poland, Austria, Hungary, Jugoslavia, Rumania, and Bulgaria. Some months ago the Skoda Works also acquired a manufacturing license from the English owners of the Sentinel steam motor truck and have undertaken its production; furthermore, it is reported that Skoda acquired the manufacturing license from the British firm for manufacturing electric automobiles under the Tilling-Stevens patents.

Construction of a small two-cylinder automobile is in progress at the small-arms plant in Brno, belonging to the Czechoslovak Government. A number of experimental cars have been turned out, and it is expected that production on a commercial basis can be started in order to put the cars on the market for the 1925 season.

The Heat Treatment of Steel Cams

By Joseph Kaye Wood
Consulting Engineer, New York City

Severe requirements on material used in cams—Carbonizing and non-carbonizing steels and their heat treatment —Advantages of alloy steels for certain types of cams

THE conversion of rotary motion into reciprocating motion by the crank arm principle is done only where simple harmonic motion is acceptable. If other than this type of reciprocatory motion is needed, cams cut according to mathematical determinations must be resorted to, although cams are also cut to give simple harmonic motion.

The function therefore of a cam is to impart a variable torque to a lever or arm, the surface contour of the former and the end of the latter, which may or may not be provided with a roller, being in contact during the transmission of the variable torque. The severe demands of present-day mechanical requirements as regards large torques, high speeds, and space limitations, has given rise to rapid repetitions of very high contact pressures. To meet these severe demands and limitations in generous use of material, metals of the following physical qualities have been developed:

1. Toughness.
2. Resistance to wear on contour surface.
3. Resistance to fatigue failure.
4. High elastic limit in compression.

In the overall or general range of requirements for cam steels, some of the above properties, or combinations of them, or in the ideal case, all of them, have been obtained in the types of steel listed below. The list shows two broad classifications depending upon whether the steel is carbonized and heat treated or whether it is simply heat treated. The carbonizing type of steel is characterized by low carbon content, while the second type may have either a medium or high carbon content depending upon the other alloying constituents. The steels used in cams are as follows:

Carbonizing Type:
1. Low Carbon.
2. Nickel.
3. Nickel-Chromium.
4. Chrome-Vanadium.

Non-Carbonizing Type:
5. High Carbon.
6. Nickel-Chromium.
7. Chromium.
8. Chrome-Vanadium.
9. Silico-Manganese.

Cam steels of the carbonizing type have been most popular in the past and are probably in greater use today. For this reason, we shall first consider the heat treatment of steels 1. 2, 3 and 4.

Plain low carbon steels are inherently tough; but they cannot be hardened to the degree required for cams. A high carbon or alloy steel may be treated to satisfy hardness, and hence, wearing requirements, but the maximum degree of hardness is attained at the expense of toughness. A steel embodying the properties of both high and low carbon steel is produced by impregnating the outer surface of low carbon steel with carbon. This process is called case hardening or simply carbonizing.

How Carbonizing Is Done

Carbonizing is performed by heating the steel in contact with carbon or carbonaceous gases to a temperature at which the carbon enters the metal. Iron has such great affinity for carbon, that when the two come in contact, diffusion will take place at the extreme surfaces of contact. To effect further penetration of the carbon atoms into the iron or steel, some additional agency is required such as pressure, or a gas whose high kinetic energy serves to force the carbon atoms deeper into the metal. Such gases are carbon monoxide and nitrogen, which are formed during the heating of the carbonaceous material packed around the cam. The quantity of carbon absorbed by iron or steel at a high temperature, but below its melting point, depends chiefly upon: (1) the composition of the iron or steel subjected to carbonizing, (2) the carbonizing temperature, (3) the length of time at that temperature, and (4) the nature of the carbonizing material. The reason for carbonizing at high temperatures, usually about 1,600 deg. F., is that the steel must be in the condition of solid solution in order to have sufficient dissolving power for carbon to produce quick and intense carbonization.

As the duration of the time of carbonization increases, the rate of penetration falls off rapidly, due to the smaller dissolving power of higher carbon steel. An average rate of carbon penetration is about $\frac{1}{32}$ in. per hour. The carbonizing period should not be too long, otherwise the outside surface of the cam or case as it is called, will be too high in carbon content. This carbon content should not be greater than eutectoid composition; because beyond this composition microexamination reveals a zone containing excess cementite. An excess of this constituent in the external zone is a source of brittleness which causes exfoliation, cracking, etc. It is this very defect and the difficulty of eliminating it by heat treatment that has led to the use of the non-carbonizing or medium carbon alloy steels.

By using carbonizing material of the solid type, however, and controlling the temperature and time interval properly, the trouble can easily be avoided. This method of carbonizing is often referred to as "pack

hardening," as distinguished from "cyanide hardening" which produces a very thin and hard case, probably well beyond that corresponding to the desirable eutectoid composition of 0.85 per cent carbon.

Carbonizing materials of the solid type, such as are used in pack hardening, are usually bought under various trade names and consist of charcoal (both wood and bone), charred leather, crushed bone, mixtures of barium carbonate (40 per cent) and charcoal (60 per cent) or of salt (10 per cent), and charcoal (90 per cent). A barium carbonate and wood charcoal mixture gives about twice the penetration of wood charcoal alone for a given period of heating and temperature. In the process of liquid or "cyanide hardening" a molten bath of potassium cyanide heated to 850 deg. C. is used which results in a quick but very superficial hardening.

Details of Case-Hardening

In the actual operation of case-hardening, the cams are packed in a box containing, let us say, barium carbonate and charcoal. Since carbonizing materials are comparatively poor heat conductors, a covering of all parts of the cams of no more than one-half to one and one-half inches of the barium carbonate mixture is essential. Carbonizing material in excess of this amount will slow up the heat penetration. The box should then be sealed and placed in a furnace in such a way that the hot gases can circulate freely and completely around the box. If partial carbonization of the cams is desired, the parts to be left unhardened are protected by an adhering coat of some material that will prevent carbonization. Copper plating is sometimes used, the coating of copper being put on by making the cam the cathode in a bath of copper sulphate and spreading an asbestos preparation or clay over the parts subsequently to be carbonized.

Since the usual low carbon steel for cams contains about 0.20 per cent carbon, the furnace temperature is regulated to about 1,650 deg. F. and maintained for about 1 to 2 hours. When hardness of case only is desired and lack of toughness or even brittleness are unimportant, the cams may be quenched from the carbonizing temperature by emptying the contents of the box in which the cams were placed in cold water or in oil. The result obtained by this procedure is a set of cams whose cores and cases are coarsely crystalline.

Reducing Danger of Distortion

In order to reduce the danger of distortion and cracking in the quenching bath, due to hardening stresses, the cams may be removed from the box and allowed to cool before quenching to a temperature slightly exceeding the critical range of the case, namely, about 1,470 deg. F. The core and case produced by this method are likewise coarsely crystalline.

To refine the grain structure of the case only, or both the core and case, the two following heat treatments are necessary respectively:

1. The carbonized cams should be permitted to cool slowly in the box within the furnace or outside to 1,200 deg. F. or below, and should then be reheated to a temperature slightly exceeding the lower critical point of the case, about 1,470 deg. F., and quenched in water, or for greater toughness and less hardness, in oil. The cams are then removed from the bath before a temperature of 200 deg. F. has been reached. This treatment only refines the case and not the core.

2. To refine both the core and case, and at the same time produce toughness in the former and hardness in the latter, the following procedure has been recommended by the Society of Automotive Engineers.

After forging or machining:

a—Carbonize between 1,600 deg. F. and 1,750 deg. F. (1,650 deg. F.-1,700 deg. F. desired).

b—Cool slowly in the carbonizing mixture.

c—Reheat to 1,550 deg. F.-1,625 deg. F.

d—Quench in water.

e—Reheat to 1,400 deg. F.-1,450 deg. F.

f—Quench in water.

g—Draw in hot oil at 300 deg. F. to 450 deg. F., depending upon the degree of hardness desired.

Step "c" serves to refine the core and at the same time to normalize the case. A subsequent re-heating (step "e") to just above 1,400 deg. F. followed by a quench, refines and hardens the case and at the same time draws the core. The refining of the core by the high quench has the added advantage of giving high fatigue and shock resisting qualities to the cam as a whole.

As pointed out previously, if the composition of the case is hypereutectoid (above 0.89 per cent carbon), exfoliation and cracking of the case will occur if not properly taken care of in the heat treatment of the cam after carbonization. In curing this condition in a case of hypereutectoid composition, an attempt is made to break up any marked segregation of cementite during the quench from 1,550 deg. to 1,625 deg. F. which is also intended to refine the core. In the second quench, wherein the case is hardened, the cementite is not segregated in network form; but is uniformly distributed as very fine particles.

Nickel steel containing about 30 points of nickel and 20 of carbon is usually case-hardened at a temperature of 1,650 deg. F. The physical properties of this steel before carbonizing, are as follows:

Physical Properties of Nickel Steel

Treatment	Annealed	Hardened at 1,436 deg. F.
Elastic Limit in lb. per sq.in.	45,000	96,000
Tensile strength in lb. per sq.in.	62,000	116,000
Elongation in 2 inches, per cent.	30.8	12.8
Contraction in area, per cent.	66.2	49.0

For case-hardening purposes, this steel is very good since great hardness (100 Shore) may be obtained in the case while still maintaining a tough core. Cams made from it should be kept in the closed furnace for only the necessary length of time to attain maximum hardness. If they are heated too long in the muffle, the toughness of the core would not be lessened, but on the other hand, the case would absorb too much carbon. The hardness of the cams thereby would not be increased but the case would probably become brittle. After the cams have become fully carbonized, they can be immediately quenched either in water or oil depending upon the toughness desired in the case.

It is recommended however to allow the cams to cool first in the box and then to remove them for heat treatment. The heat treatment consists of reheating the cams to 1,450 deg. F. and quenching in oil or water. By this method the toughnes of the core is considerably increased. There is no advantage in using a higher temperature for hardening than 1,450 deg. F., because the surface hardness easily suffers deterioration.

A better method of heat treatment for this steel is as follows:

After carbonizing at 1,650 deg. F.

a—Quench in water or oil.

b—Anneal at 1,100 deg.-1,250 deg. F. for ½ hour, cooling slowly.

c—Reheat to 1,400 deg.-1,450 deg. F.

d—Quench in water or oil.

Nickel-chromium steel containing about one per cent nickel and 0.20 per cent carbon, is used for cams requiring greater strength than those made of nickel steel. The carbonizing of this type of cam is carried out along the same general lines as for carbon and nickel steel cams. The complete heat treatment is as follows:

After forging or machining:

a—Carbonize between 1,600 deg. F. and 1,750 deg. F. (1,650 deg.-1,700 deg. F. desired).

b—Cool slowly in the carbonizing mixture.

c—Reheat to 1,500 deg.-1,550 deg. F.

d—Quench.

e—Reheat to 1,300 deg.-1,400 deg. F.

f—Quench.

g—Reheat to 250 deg.-500 deg. F. (in accordance with the necessities of the case, namely about 95 Shore hardness, and cool slowly).

Cams made from steel containing about 0.20 per cent carbon, 0.70 per cent chromium and 0.15 per cent vanadium are carbonized by packing them in a box filled with a hardening compound and placing the box, properly sealed, in a furnace. The temperature of the furnace is slowly raised to 1,650 deg. F. and held there for a period of 3 hours, after which the cams are allowed to cool in the furnace overnight.

The cams are now removed from the carbonizing box, heated in a muffle furnace up to 1,550 deg. F. and then quenched in oil. This is followed by a reheat to 1,350 deg. F. and quench. The cams are then drawn slightly if necessary to obtain a hardening of about 95 Shore.

Non-Carbonizing Steel Cams

Where no severe strains are imposed on light sections of the cam, an ordinary carbon steel containing about 0.95 per cent carbon is used. The heat treatment of cams of this type, as recommended by the Automotive Engineers, is as follows:

a—Heat to 1,425 deg.-1.475 deg. F.

b—Quench in water.

c—Draw to 300 deg.-600 deg. F. to give a Shore hardness of about 90.

Nickel-chromium steel cams containing 2 per cent nickel, 0.50 per cent carbon and a small amount of chromium are heat treated as follows:

After forging:

a—Heat to 1,475 deg.-1,525 deg. F. (Hold at this temperature one-half hour to insure thorough heating.)

b—Cool slowly.

c—Machine.

d—Reheat to 1,375 deg.-1,425 deg. F.

e—Quench.

f—Reheat to 250 deg.-550 deg. F. and cool slowly.

Chromium steel, No. 7 in the list, contains 1.0 per cent chromium and 0.95 per cent carbon. The heat treatment is the same as for the previous one except that the draw is made to produce a shore hardness of 100.

Chromium-vanadian steel containing 1.0 per cent chromium, 0.95 per cent carbon and a small amount of vanadium is heat treated to give a Shore hardness of 100. The procedure is as follows:

After forging:

a—Heat to 1,525 deg.-1,600 deg. F. (Hold for about ½ hour.)

b—Cool slowly.

c—Machine.

d—Reheat to 1,650 deg.-1,700 deg. F.

e—Quench.

f—Reheat to 350 deg.-550 deg. F. and cool slowly.

Silico-manganese steel for cams contains about 2 per cent silicon, 0.60 per cent carbon and a small amount of manganese. The SAE heat treatment for cams made from this type of steel is as follows:

After forging or machining:

a—Heat to 1,650 deg.-1,750 deg. F.

b—Quench.

c—Reheat to 400 deg.-1,200 deg. F. and cool slowly to a hardness of 100 Shore.

Grinding of Cams

All rough machining or forging of cams is done before hardening. In the case of forging, an annealing previous to any regular heat treatment is necessary in order to relieve all forging strains and to refine the grain structure. After complete heat treatment, the contour surface or surfaces of the cams should preferably be ground, since comparatively rough milled surfaces act like a cutter on the cam roller, thereby producing appreciable wear. The grinding also eliminates any warp in the cam due to distortion caused by the hardening stresses. The chromium and nickel-chromium steels, when properly heat treated, have the least distortion and are favored for this reason.

The question as to whether cams should be made of the carbonizing or non-carbonizing type of steel depends very much upon the service requirements and manufacturing facilities. If the cam is to be subjected to severe impact blows, or the heat treatment is liable to be erratic, due to the lack of proper equipment or if the particular product does not warrant finely controlled heat treatment, then the alloy steels of the non-carbonizing type are decidedly superior. The carbonizing type cannot be used under these conditions because the case would be likely to scale, thereby exposing the relatively soft core underneath.

Census of Auto Parts Manufacture

The Department of Commerce announces that, according to the data collected at the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of motor-vehicle bodies and parts reported products valued at $1,013,113,010, an increase of 148.3 per cent as compared with 1921, the last preceding census year. This industry is made up of those manufacturing establishments whose principal products are motor-vehicle bodies, tops, wheels, radiators, fenders, wind shields, transmissions, mufflers, axles, steering wheels, and various other assemblies and parts.

Motor-vehicle bodies and parts are also manufactured to some extent as secondary products by establishments engaged primarily in other industries. The value of such commodities thus produced outside the industry proper in 1921 was $24,902,031.

The Book of Failures—Discussion

By C. G. Williams

THE article under the title given above, By M. O. Rider, on page 426, Vol. 61, of the *American Machinist*, hits the spot in every case.

After being out of railroad work for about two years, I returned and my first job was:—"Reduce brass on back on end of right, high-pressure main rod. Runs hot." The main rods were inside of the frames as the locomotives was of the four-cylinder, compound type, commonly call "balanced compounds." The brasses were 5½ in. wide and the bore was 12 in. There was a fillet of 1½-in. radius on each side, which left a 2½-in. bearing surface on each brass.

When the rod was taken down, by removing the strap bolts, pulling the strap part way back and then pulling the crosshead ahead until the main rod came out of the strap, the brass fell out in about twenty pieces. Being of an inquisitive turn of mind, I closely inspected the pieces. They were porous in spots, especially adjacent to the broken surface, while on the fillets was a layer of what seemed to be lead or soft babbitt. The brass showed signs of having the lead and zinc segregated until spots of babbitt or a mixture of lead, zinc and tin of from ¼ to ½-in. diameter were found.

The foreman complained about my standing around loooking at the pieces, for it was a rush job, so the pieces were put away for later use and a new brass was fitted. The engine had been fired up and was taken out of the house as soon as the last strap bolt was tightened. The foreman was pleased over the quick job and informed us that those d—— engines needed a new set of brasses every time they came in from a trip.

Trouble with the New Brasses

When the engine came in from the trip the next day with a hot brass as well as a broken one, I was called up on the carpet and the master mechanic with much profanity and pointed words informed me that:—"unless I could do a better job than that, my job would be missing." Of course I got hot and told him that he could go to H—— with his job, but that the engines would run him off the division unless he got a different type of brass; that a bronze was needed and not a cheap brass which had lead, zinc and tin segrated in lumps. This took the wind out of his sails and he asked what was meant. The pieces of brass were brought to him and he studied long and cursed loudly.

For three months there was a new set of brasses put in the back end of the mainrods every second day, and only about 360 miles of service could be obtained from a set. There were 25 engines of this type on the road, and all behaved alike. To my knowledge no better brasses were ever obtained. At last the engines were remodeled to simple engines.

Years later, I accepted a position as foreman of the link bench on another road. This job had the overhauling of main and side rods.

The road had some modern locomotives that were advertised as being, in 1923, the largest and heaviest locomotives pulling passenger trains, in the world. They had exceptionally heavy main rods, most of the weight being in the back ends. Instead of the usual split brasses in the back ends, they were equipped with floating bushings. These engines had been in service but a short time, but it was about four months from the receipt of the first engines, before one of the floating bushings needed to be removed.

The road is all grades and this division was 1.6 per cent grade for its 80 odd miles of length. We put in a new bushing and she drifted down the hill. Replacing bushings continued for about ten days, when the mechanical inspector came to the shop on his regular duties. He inquired as to the reason for so many bushings in the back end of the main rod of this engine, and acknowledged that he was at a loss as to what was the matter. Several pieces of the burned brass were shown to him, and an explanation made of the reason it burned out.

Trouble Not Cured

Letters were written to the main office and were referred to the shop where the brasses were cast. Explanations showed that the trouble had been correctly diagnosed. The result was a new set of castings that the foundry foreman guaranteed would hold up. The new castings were of better material than the old ones, but they also burned out in one round trip. Again the mechanical inspecter called and was shown the pieces of brass. He asked if there was a way to remedy this condition and was told that the road must get a high grade bronze instead of cheap brass. He asked for a formula for bronze. This was given him and he departed.

When the mechanical inspector arrived at the main office, he explained the trouble to the superintendent of motive power and the foreman of the brass foundry was called in. When he made a statement of the probable cost of bronze castings, the superintendent of motive power would not listen to him, so a cheaper bronze was substituted. The cheap bronze lasted two trips and burned out when coming up the grade on the third trip.

I was called up on the carpet by the master mechanic, but the coming of the mechanical inspector saved my job for me. He immediately returned to the main office and demanded a show down. He asked for four, only, castings for bushings of the formula I had been given him, stating that if this did not remedy the defect an expert must be called from the shop where the engines were built.

The main pin had been badly scored by the brass on this last trip and, as we had no quartering machines nor a portable machine for truing up pins, I was set at the task of filing ¼ in. of metal off the surface of the pin. It was 10-in. diameter and 12-in. long. This meant 18 hours per day for seven days, but it was a job when finished.

The new bronze castings arrived the day the pin was finished and much comment was made over the way they machined, for they were harder on the tools than steel, and the chips came off on long, reddish yellow shavings. The bushing was put in place after having been stamped for identification, and notation was made for the files of the master mechanic's office. This bushing was still running strong when I left the road four months later.

Which was the cheaper bushing? The cheap brass, one lasting one trip or the high priced one lasting four months? This is only an example of how some of the railroads save money, but it is not written in the "Book of Failures."

Wear of Reduction-Gear Teeth Measured from Plaster Casts

By H. B. Chapman
Manager Steam Marine Division
Westinghouse Electric & Manufacturing Company

How an accurate cast of a helix or tooth can be made — Method serves to keep complete record of reduction gear wear

NO MATTER how experienced an engineer may be, he cannot by visual inspection judge with any degree of certainty the wear that has taken place on the teeth of gears. Any records made by such a method would at best be of very general interest and would be of no value for engineering or design. In fact, it is hard to imagine how they could be used at all.

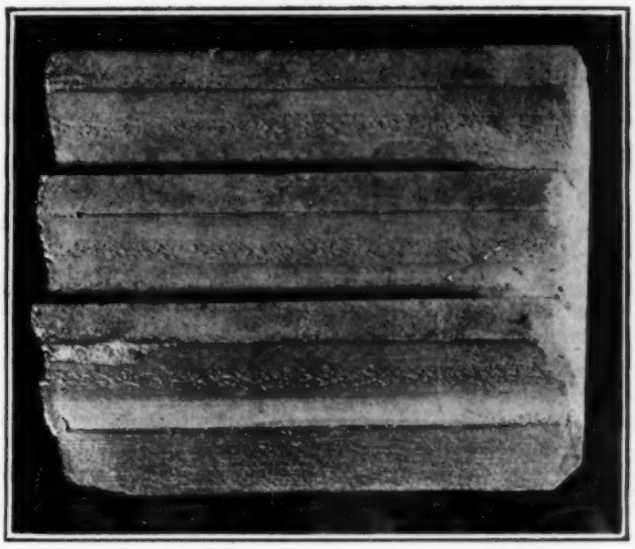


Fig. 1—Cast of driven side, forward marine helix.

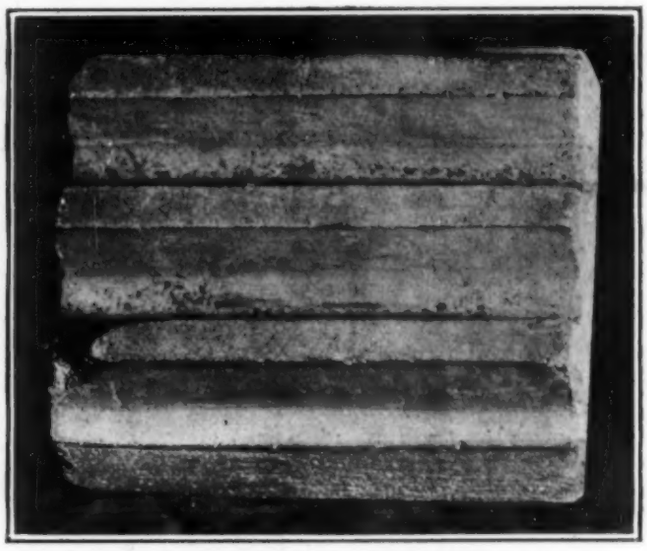


Fig. 2—Smooth idle side of same cast as in Fig. 1

Desiring to keep a complete record of the life of reduction gears on turbine-driven ships, the Westinghouse Service Department developed a simple and inexpensive yet thoroughly reliable method of making permanent records of the condition of the gear teeth. Not only is it possible, after a short acquaintance with the system, to foretell the approximate life of the gear, but some interesting facts were brought to light on the subject of undercutting and pitting.

The requirement for a satisfactory record is an exact full size reproduction of a section of the gear at the time the record is made. The method employed in making the artificial stone cast is practically identical to that used by dentists in making casts for plates of artificial teeth. The negative impression is produced with paraffin wax. The better grade of wax, such as made for domestic purposes, is best, being harder and having a higher melting point. We have found wax by the trade name of "Gulfwax" very good.

The teeth should be wiped clean and dry and marked permanently, so they can readily be located when it is desired again to take a cast. A dam built around the sections to be molded should be parallel to the face of the teeth and about 3½ in. wide by 5 in. long. For this purpose ordinary putty mixed fairly stiff works very well. The dam should extend ¾ in. above the top of the teeth with sufficient melted wax poured in to fill the dam completely.

When the wax has become quite solid, the putty can be removed and the cast pried up with a penknife from the bottom of the teeth. The wax negative is then mounted on a piece of board a little larger than itself and the same putty used to make the sides of the plaster mold.

A preparation used by dentists, called "Spence's plaster," which is a refined portland cement, proved suitable for this work. It is sold by most dental supply houses at about $2 for a nine-pound carton. This is mixed, preferably in a dentist's rubber plaster bowl, by adding the plaster to water, continually joggling the bowl to exclude the air bubbles. The cement should be mixed quite thick, in fact like soft putty, and then pieces about one inch long are taken up, rolled in the hand and laid between the teeth in the center of the wax cast. By continually rapping the cast on the table, the plaster

will spread the full length of the teeth. The gradual filling of the mold in this way will exclude all the air bubbles and pockets.

We also found that the shrinkage in the wax negative gives a slightly larger plaster cast, which in turn shrinks when thoroughly dried out to practically the identical size of the tooth, permitting the use of a tooth gage on the cast, which shows what is going on very clearly. The plaster should be allowed to set at least

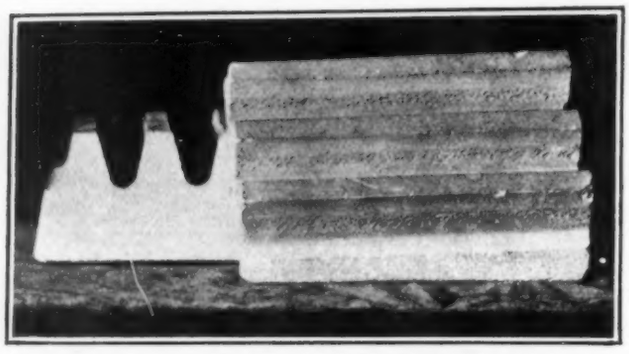


Fig. 3—Driven side of helix shown in foreground

six hours, the wax melted out or pried off, and the cast dressed up with a hacksaw and file.

At present all necessary information concerning the gear is written on a label which is affixed to the base of the cast, the whole base being then given a coat of waterproof varnish. A sample of the class of informa-

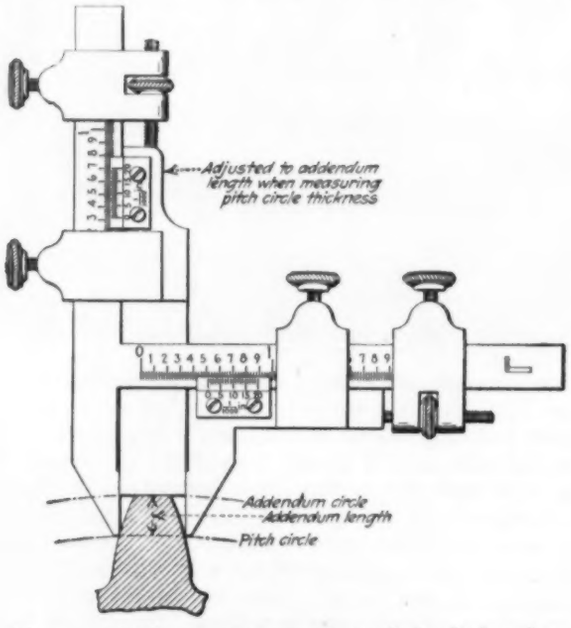


Fig. 4—Thickness measured at pitch circle when addendum length is known

tion required on the label of a marine gear cast is given in the table for the guidance of those who may see an application of this recording system in other fields.

CAST OF S. S. MOUNT CARROLL

Main gear	Forward helix
Impression taken	May 26, 1923
Thickness at date	0.446 in.
Addendum	length, 0.286 in.
Thickness when new	0.448 in.
Operation to date	130,000 miles

Although this method was originated for marine use, it is applicable to any kind of gear teeth. Figs. 1 and 2 are both from the cast of a forward marine gear helix. The wear is plainly indicated on the driven side of the tooth cast, Fig. 1, and the smooth surface is evident on the idle side, Fig. 2. The driven side of the after gear helix appears in the foreground of Fig. 3. Tooth thickness may be measured as at Fig. 4, where the measured thickness is preferably at the pitch circle. The addendum length must be known so as to adjust the caliper for taking this thickness. If not known, some standard length must be chosen and recorded, so it can be used in measuring subsequent casts.

A study of a number of gear impressions brought out the fact that apparently much of the wear is a flaking action, which when it becomes intensive, causes a continuous depression below the pitch line, termed

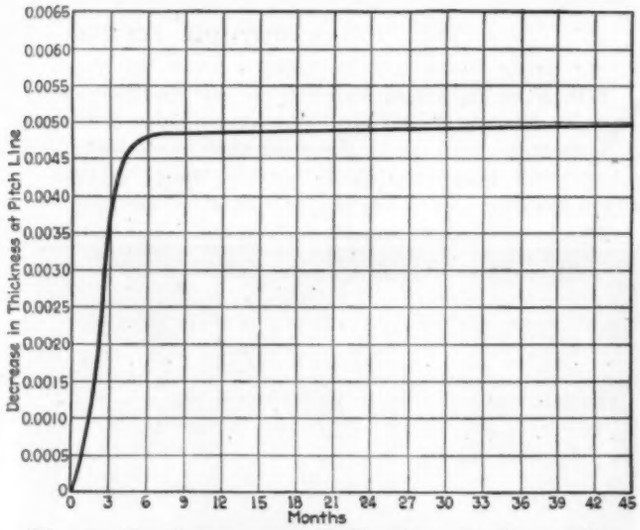


Fig. 5—Tooth wear practically stops in six months

undercutting. The blow delivered by the pinion tends to crystallize the metal which receives the blow and it finally flakes out, giving at first glance a deceptive idea of the amount of wear that actually is taking place. It was also found that this wear falls off gradually while the gear is in service, finally ceasing altogether, leaving a gear the useful life of which will exceed the life of the ship in which it is installed.

A series of records, taken at intervals of three or six months, might at first lead the observer to believe that the gear was doomed for the scrap pile within a year. But it was found that ships having approximately a half-billion miles to their credit, such as the S.S. "Maui" (400,000 miles at last inspection) and the S.S. "Goloa" (250,000 miles at last inspection), show less wear as time goes on. In Fig. 5 is shown a curve made from the gears on one ship.

According to F. L. Rhodes, in a talk before the American Engineering Standards Committee, standardization is a useful servant but a bad master. If improperly used, in a rigid, uncompromising way, it may fetter progress. If properly used, standardization will be found to be a valuable aid to progress. Whether it becomes a hindrance or an aid to progress will largely depend upon the degree of flexibility of standards that is maintained, which involves a working arrangement so set up as to facilitate revision, and the full utilization of this arrangement by making revisions whenever this can advantageously be done.

The Other Side of Labor Turnover

By William Davenport

The excessive cost of labor turnover to industry—The cost to the man himself—Importance of specializing on one kind of work—Duty of the foreman

WANTED: Twenty competent operators at once. Best of working conditions. Drifters need not apply. We want people who will stick. Apply 30 Blank Street, Monday morning.

The above advertisement appeared in one of the leading papers in the city of Baltimore some weeks ago, and it serves to illustrate, better than anything else, one of the greatest problems in modern industry.

Statisticians and investigators are constantly busy telling us of the frightful cost of labor turnover to the employer. Mr. W. H. Alexander, of the General Electric Company, reports one investigation which revealed that 12 factories where 44,000 men were employed at the close of the year, had during the twelve months hired 42,500 new men in order to keep going. This is a turnover of about 95 per cent and Mr. Alexander estimates the cost of those unnecessarily hired at $8,331,000. In 1914, Mr. Grieves made a survey of 20 factories in which he places the cost of needless turnover at $1,760,000.

However excessive these figures may seem, it must be remembered that lowered production while the worker is learning his new job, spoiled materials, broken machinery and the increase of accident hazard all combine to pile up an enormous cost that must be borne ultimately by the consumer.

It is quite obvious that if we are ever to get back to the place where income and expense are not so far apart, something must be done to remedy this situation. Just what shall be done and who shall do it is a question subject to the widest variation of opinion. But there is one point upon which there must be pretty general agreement—that the shop executive, if he be wise and willing, can play a large part in preventing such enormous turnover. He is the leader of men. He is the builder of morale. He stands between the employer and the worker. His very position gains for him a certain amount of respect and confidence that gives him a distinct advantage in dealing with men under his supervision.

Why Are There So Many Separations?

But any attempt to render this service to industry must be preceded by a careful diagnosis of conditions to discover the cause of so many separations. Frequently these reasons are within the plant and are fully justifiable. When a product is subject to seasonal fluctuations, it becomes almost impossible to maintain a fully organized personnel at all times. Sometimes business depression, either in his own field or in kindred lines, makes retrenchment imperative. When these conditions demand a curtailment of the working force, there is little that such leaders can do.

It is, however, the general consensus of opinion among personnel men that more than half of these separations are voluntary on the part of the workers and if this be true, the whole question needs to be studied from another angle. Here each case must be dealt with on its own merits and the clear thinking foreman will begin by making a careful analysis of the situation. A frank talk with the man who wishes to make a change will reveal the fact that many times his reasons are perfectly valid. Wages are sometimes inadequate and when this is true any self respecting man who is conscious of the domestic responsibilities resting upon him must seek every possible opportunity to better himself.

The Worker's Problems

The education of his children is just as important to the worker as it is to those with whom the financial problem is not so large. If proper schools are not available, he should endeavor to locate where his young people may have the training to equip themselves for a place in the world.

High rentals and poor housing conditions are factors vital to his welfare. When it becomes impossible for a man to give his family a reasonable measure of comfort or when surroundings are unsanitary to a serious degree, it will be his duty to move where he can escape this handicap, if such a place can be found.

Again, the job may be one where his physique makes it impossible to properly adjust himself to it. Occupational diseases may be prevalent or climatic conditions may be unfavorable for himself or his family. To insure health he should seek new fields and fairer skies.

And sometimes working conditions may be below par. The absence of proper light and ventilation, inadequate safety guards or unfair and partial treatment by executives should be sufficient reasons for seeking a new job.

But we are convinced that any or all of these reasons cannot account for the enormous turnover freely admitted in the industrial plants of today. If we take the statements on the worker's personnel card as to why he changes jobs at their face value, these reasons will always appear justified. But every foreman and superintendent knows that there are other and usually secret reasons back of those openly stated. And they know also, that in many instances these reasons are trivial and the action ill considered. Very often it is merely some fancied affront or some temporary disagreement that sends a man scurrying off after another job. An investigation of five such separations led us to believe that three made the change only because some

friend painted a rosy picture of superior working conditions in another factory. The two other men finally admitted that they made the transfer merely in order to try something different.

Such instances as these simply indicate that many men are superficial workers. They never make any deliberate effort to become specialists in their line of work. Others are appalled by monotony and crucified by long hours. And when the burden becomes too heavy, people of this type rush off to seek for something that requires either less effort or less skill. In short, there is a fatal instability in human nature. Men seem to be the victims of a sort of psychological flux that makes impossible the persistence so essential to success in any line.

In dealing with the restless and dissatisfied worker, a foreman can do much by trying to help him get a sane viewpoint of every possible result of the proposed change. He can bring up and discuss such questions as these:

Can the man be certain that, all things considered, the new position will pay more than the present one?

Will his new work be subject to labor difficulties?

What change, if any, will the transfer make in his social position or his standing in the community?

How much further along will he be in ten years than if he remains where he is?

Is his desire for a change the result of judgment or pique?

It would be advisable to remind the operator that every such transfer holds a definite possibility of actual financial loss. A recent instance worked out in figures—and which might be duplicated without going outside of your own plant—showed the following:

One week's time in making the change	$35.00
Moving expenses	20.00
Increased house rent, $5 per month (3 months)	15.00
Lowered production for three weeks (piece rate scale) in getting adjusted to new methods and new conditions	12.00
Total	$82.00

If all the facts were available, it is probable that the showing would be more serious than is indicated here, but the actual monetary loss in this case is large enough to make any man hesitate and study the facts carefully before making a hasty decision. And it is simply because men do not think things out clearly and fully that we often see a man at 40 or 50 years of age, just when he should be at the very peak of production efficiency, starting out on a new career. When a man has his mind made up to seek a new job it may require the utmost tact to alter his decision, but there are many arguments that can be used and facts cited that will be helpful if rightly presented.

Call his attention to the men who have wrought really big things in the world—James J. Hill, Cyrus Field, the Mayo brothers and hundreds of others—and you will find that they have been men of one idea. They decided upon one line of work or business and they stuck to that through all the fluctuations of fortune and all the difficulties of achievement.

A young man once asked Giardini, the great virtuoso, how long it would take to master the violin. The reply was, "Twelve hours a day for twenty years together." And this is true, not only of music, but of everything else in the world. Every man is a merchant. He has something to sell. It may be clothing, food, furniture or money. When he starts in business, he places certain things on his shelves. These tangible and material things are his assets—the very heart and life of his business. If he throws these assets away or allows them to deteriorate, he is wilfully negligent or criminal.

Every industrial worker is a merchant. His assets, the materials of his business are knowledge, strength, experience, skill. If he vitiates them by constantly shifting from one job to another he is not only working an injustice to his employer, but he is injuring his own resources and reducing his opportunities for advancement.

It is well to remind the discontented worker that there are few qualities in human nature more valuable than STA-bility. There is, to be sure, a healthy discontent that is a spur to all success but it is one that arises within a man's job rather than against it. Show him that no job has ever been done so well that it could not be done better. If he can find a way to do it better, he will conquer monotony and at the same time, win material reward.

In short, convince him that, in the long run, the stayer wins.

Machine Efficiency

By Benjamin Carroll

Machine efficiency is an element of cost that is often plotted wrong in the manufacturing shop, which has engineers or draftsmen who can determine the production very accurately. The layout of the piece as given to the production department is a conservative estimate of the productive capabilities of the machine.

The first or accurate estimate is for the gross production, whereas the conservative estimate is 90 per cent of the gross to allow for machine and tool trouble. The conservative estimate provides a rate for the planning department to use.

There are two methods for plotting efficiency which are practically governed by the cost system. The first method is to find the percentage of the actual production to the gross; the second, to find the percentage of the actual to the net.

Machine and tool trouble are charged against the machine efficiency, belt trouble to overhead, no stock to the production department and no operator to general.

For example: A machine is capable of producing 100 pieces an hour, the shop runs 9 hr. per day, the machine is stopped 0.5 hr. for machine trouble, 0.5 hr. for tool trouble, 0.5 hr. for belt trouble, 1 hr. because of no stock, and 1 hr. because of no operator.

Efficiency by First Method

Actual production, 650. Gross, 900

Efficiency 72 per cent.

Efficiency by Second Method

Actual production, 650. Net, 750

Efficiency 87 per cent.

It is stated above that the net production is 90 per cent of the gross to allow for tool and machine trouble which in most cases is under 10 per cent; the net production is equal to the actual production hours plus the hours of tool and machine trouble multiplied by the standard.

The first method of plotting efficiency is not correct, as the machine is not responsible for the failure of the production department to furnish stock or the foreman's failing to assign an operator.

Jigs and Dies to Reduce Shop Costs

By Charles Gordon
Western Editor, *Electric Railway Journal*

Chicago Surface Lines use special tools to make many parts in punch presses — Automatic stripping and ejection of the finished parts speeds up production

IN THE West Shops of the Chicago Surface Lines many dies and jigs have been developed to hold down the cost of making replacement parts for car equipment. As a result, the number of hand operations has been reduced to a large extent and the punch press has been substituted for hammer, saw, file and drill press. These special tools have been made up from time to time over a number of years, the high wage scales prevalent in Chicago being an added incentive. Although many different types have thus been developed, each expenditure for new dies is carefully supervised and the cost of a proposed new tool is compared with the estimated saving to be made before the work is authorized.

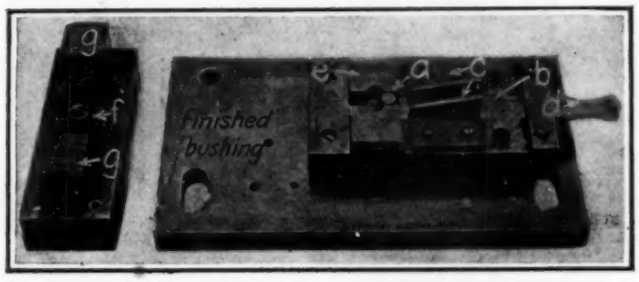


Fig. 1—Die for rolling bead on bushings

An endeavor is made to avoid the tendency in railway maintenance practice of manufacturing parts that can be purchased cheaper from other sources. In some cases, however, the decision is determined by the time element in delivery. Special parts that are required in comparatively small quantities frequently cannot be purchased at an attractive price except in large lots. Consequently the cost of carrying large stocks of such parts sometimes makes it desirable to manufacture them in the shop. Since punch press dies can be set up quickly in the machines, it is possible to manufacture comparatively small lots of special parts at prices that more than justify the cost of making up the dies.

The punch press equipment available was originally purchased for maintenance purposes and is not particularly suited to quantity production. It consists mostly of comparatively slow, heavy-duty machines. With the exception of one motor-driven V. & O. Press Company No. 21 punch, these are limited to a Williams, White & Company No. 14 press, a Long & Allstatter combined punch and shear and one other heavy-duty, deep-throat punch. The various types of dies and jigs that have been designed increase the service obtained from these machines. Since there is nothing unusual about the machine equipment available in these shops, the tools to be described are of types that can be utilized with the machines found in most railway shops.

In the accompanying illustration, Fig. 1, is shown a die for making push button bushings for the passenger signal bells on a comparatively large group of cars. This particular type of signal is no longer on the market, and repair parts are therefore not available from the original manufacturer.

The bushings are made of thin brass tubing, with a bead rolled on one end to protect the passengers' fingers. They are first cut off in a screw machine and the bead is then rolled by the punch and die shown in the illustration. The piece of tubing of proper length is slipped on the pin (*a*) projecting from the sliding member (*b*) shown in the illustration. This slide extends out to the right from the body of the die to form a handle at (*d*) which can be grasped by the operator. When the slide is pulled out to the extreme right the pin (*a*) is exposed so that the piece of tubing can be readily dropped into place. The sliding member is then pushed to the left until it strikes a stop. This places the bushing between the two halves of the split forming die (*e*), shown open in the illustration. This is held open by compression springs and is arranged so that the two halves of the die are free to slide in the die block. When the punch, shown at the left, descends, the two heavy lugs (*g*) engage tapered outer faces on the split die (*e*), and as the punch comes down into position the two halves of the die are brought together so as to clamp securely the bushing between them. The top of the bushing is rolled by the punch (*f*) in the center. When the punch is raised from the die the two split members are forced apart by the compression springs mounted between them, thus releasing the bushing and the hand-operated slide (*b*) so that the latter can be pulled to the right by hand. When this is done the newly rolled bead on the top of the bushing en-

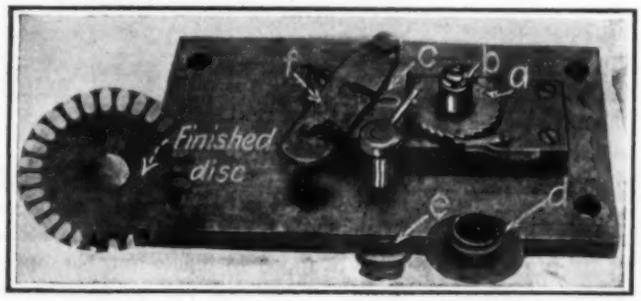


Fig. 2—Indexing die for armature insulating disks

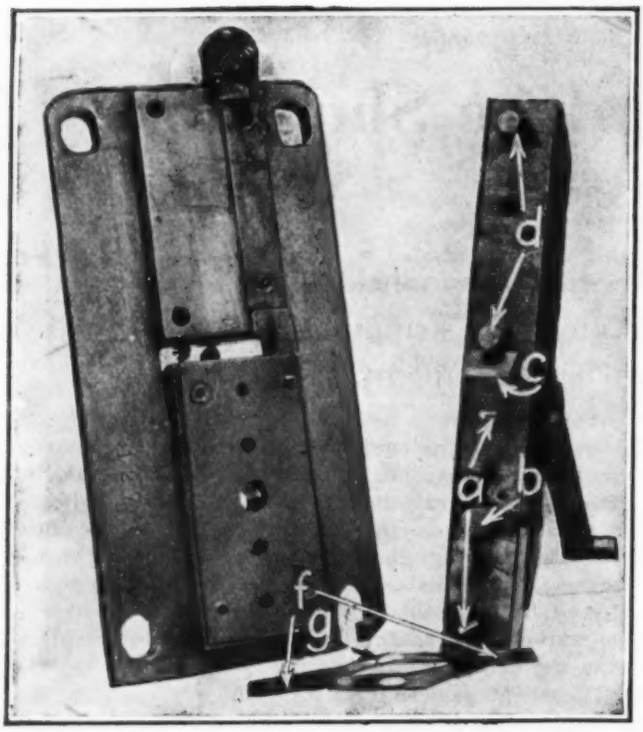


Fig. 3—Combination die for ribbon fuses

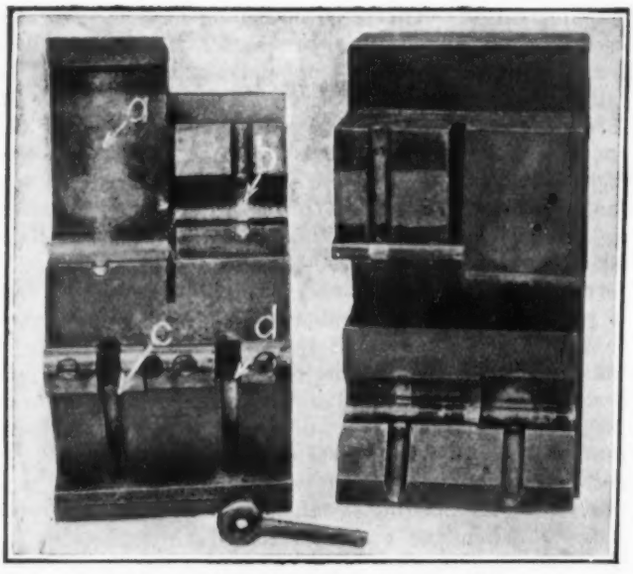


Fig. 4—Forming dies for eye-bolt

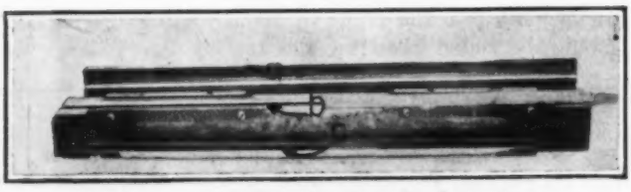


Fig. 5—Brass channel forming die

gages the two inclined surfaces (*c*), and as the sliding member continues toward the right the bushing is automatically drawn off the pin, so that another piece of tubing can be quickly dropped in place, and the operation repeated. This job is carried out on a V. & O. No. 21 motor-driven punch at the rate of approximately 2,000 pieces per hour.

A good example of an indexing die for making a number of equally spaced cuts in a single piece of material is shown in Fig. 2. This is used for cutting the slots in the circular fish paper insulation used in small ventilating fan motor armatures.

The round disks are first blanked out of sheet material. The slots for the windings are then cut in the die shown. A disk is slipped over the spindle (*b*) and the guard (*f*) is fastened in place to act as a stripper. The collar (*d*) is then slipped on the spindle (*b*) and the cap (*e*) is placed on top. This cap is provided with a projecting pin on the inside which enters the vertical slot near the top of the spindle (*b*). By pressing down on this cap the spring inside the collar (*d*) is compressed. The cap (*e*) is then given a partial turn so that its pin engages the circumferential slot shown near the top of the spindle (*b*), thus holding the collar (*d*) securely in place and clamping the disk of fish paper on the ratchet wheel (*a*). The various parts just described are all clamped together through the action of the spring inside the collar (*d*), but are free to rotate about the vertical pin in the center of the spindle (*b*).

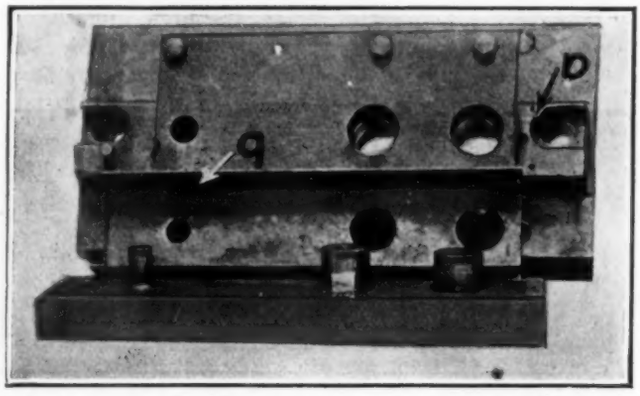


Fig. 6—Die for punching truck pedestal channel wear pieces

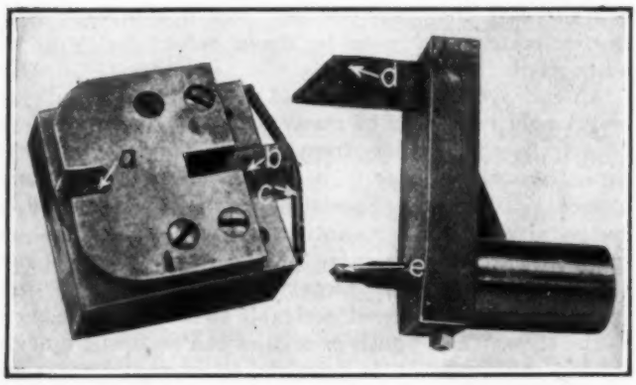


Fig. 7—Die for punching structural members

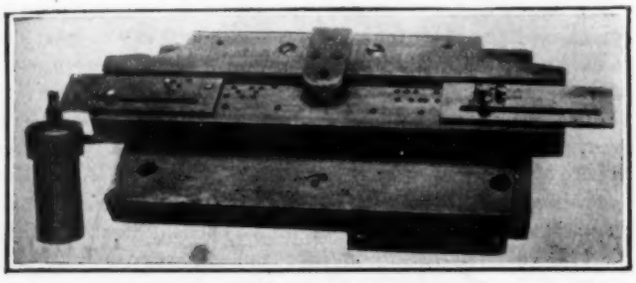


Fig. 8—Adjustable drill jig

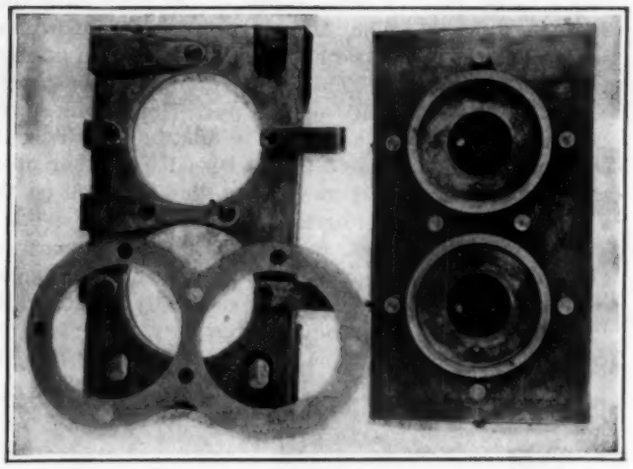


Fig. 9—Die for punching cylinder head gaskets

A spring engaging the notches in the ratchet (*a*) allows it to be rotated by hand, one notch at a time, corresponding with the spacing of the slots to be punched in the disk. As the piece is rotated, it is thus indexed to give the required number and spacing of slots. The work is done in a Williams, White & Co. No. 14 power punch press at the rate of 25 complete disks per hour.

In Fig. 3 is shown an ingenious die for making car ribbon fuses from thin strips of copper. The copper ribbon is purchased in rolls 1 in. wide and 0.005 in. thick. Two of these thicknesses of material are fastened together and a calibrating hole is punched in the center, to form the complete fuse, as shown at the bottom of the illustration. This has been pulled apart to show the two ribbons of copper. The entire operation of making these fuses is completed in the die shown, as a continuous process. The two ribbons of material are fed into the die from two different rolls. The projecting prongs (*a*) on the die pierce the two strips of copper in such a manner as to leave a projecting burr at two points spaced so they will come near each end of the completed fuse. At the same time the center hole (*g*) is punched in the ribbon. As the material is pushed forward again in the die, against a stop which fixes the proper length, the two projecting punches (*d*) flatten the burrs that were made at (*f*) so as to fasten the two pieces securely together. At the same time the descending cutter (*c*) cuts the completed fuse off to the proper length. The operation is then again repeated. This work is done in the V. & O. No. 21 press at the rate of about 3,500 complete fuses per hour.

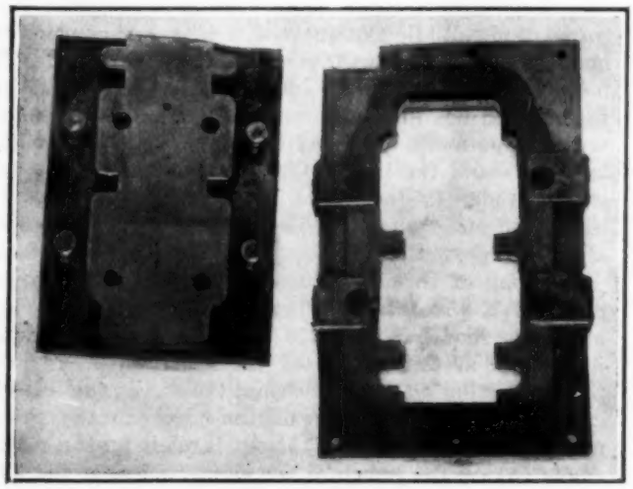


Fig. 10—Another gasket die

Two forming dies of widely different types are illustrated in Figs. 4 and 5. The one shown in Fig. 4 is used for the manufacture of the small eye-bolts shown at the bottom of the illustration. This is part of the car fuse box assembly and is made up cold from ⅛-in. round, cold rolled steel. The pieces are sheared to the proper length and are then formed in four operations. The successive stages of the forming are carried out in order on the four sections of the die marked, respectively, (*a*), (*b*), (*c*) and (*d*). The piece is moved from one position to the other in the die so that it requires four movements of the press to complete the operation. In the first position (*a*) the rod is kinked up at one end. In position (*b*) this kink is depressed so as to bring the stem approximately at the center of the loop. In positions (*c*) and (*d*) the loop is finally completed. The work is done in a Williams, White & Co. No. 14 press at the rate of 75 pieces an hour.

Brass channel wearing pieces used to reinforce the stiles of body sash are formed from No. 18 gage strips

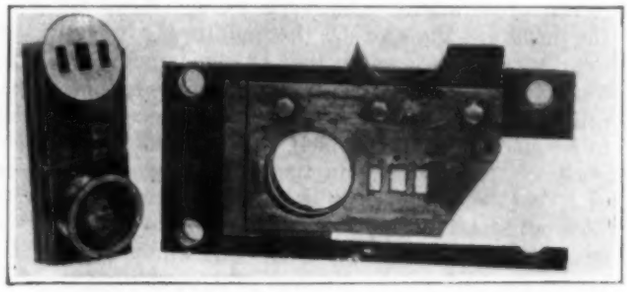


Fig. 11—Die for engineer's valve gaskets

of the proper width in the punch and die shown in Fig. 5. The completed channel is shown at (*c*) in the illustration. The punch and die shown are used to form the channel only, the screw holes and cuts for the sash locks being made in a second die that is not shown. In the same press these are formed at the rate of approximately 40 per hour.

An excellent example of a die which substitutes punching operations for what would ordinarily be a drill press job is illustrated in Fig. 6. The large holes in the channels that are used as wear pieces on truck pedestals are punched instead of being drilled. The block (*b*) in the die supports the web of the channel so that it can be punched without distorting the flanges. These channel pieces are also sheared to the proper length in a similar die designed to support the piece, so that both the web and the flanges are cut off clean. Both 14-in. and 16-in. lengths of channel are required for different types of trucks, and an adjustable pin at the left of the die shown in Fig. 6 enables the same die to be used for punching pieces of either length. The punching is done in the Williams, White No. 14 press at the rate of 60 pieces per hour.

In most railway shops the punching equipment is not suitable for making a number of holes in small structural members which have been laid out with center punch marks. This is due to the fact that such punch press equipment is usually of the rotating type, on which the punch stops in a raised position, making it difficult to locate the center punch so that the hole

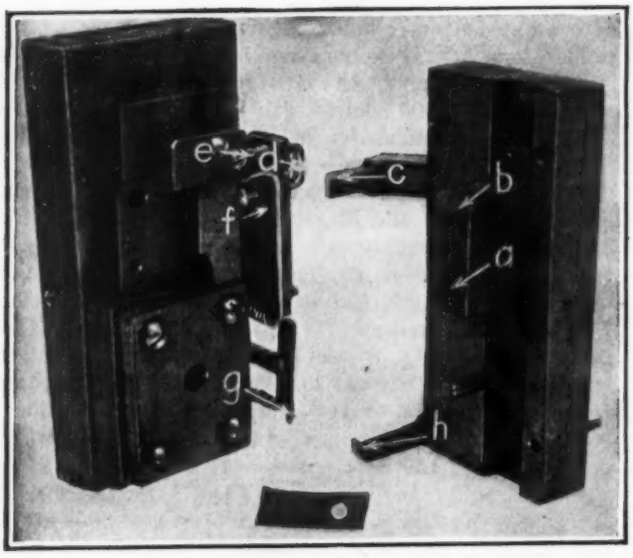


Fig. 12.—Combination die with ejector

will be in exactly the proper position. The device shown in Fig. 7 was designed to make an ordinary punch press suitable for such work. When set up in the machine the end of the pointer (*a*) corresponds exactly with the center line of the punch (*e*). When the work is moved, so that the end of this pointer coincides with the center punch mark locating the hole to be made, the punch itself will descend in the proper position. The pointer in the die is carried on the end of a cross slide having a slot near the rear end at (*b*). This slide is normally held in the forward position against a stop by the spring (*c*) which is stretched across the back of the die, and presses against the slide. A wedge (*d*) carried on an extension back of the punch enters the slot (*b*) as the punch descends and forces the slide back so as to move the pointer out of the way while the hole is being made in the material. As soon as the punch is again raised the pointer (*a*) returns to its normal position and is ready to locate the next hole.

To make up different dies or jigs for each of a large number of similar parts which vary slightly in size and position of holes becomes a very expensive matter. In Fig. 8 is illustrated an adjustable jig which is indexed so that a comparatively large number of similar parts of varying dimensions may be all punched on the same piece of equipment. This is used for punching the holes in controller cylinder segments before they are formed. Pins in the slides at each side of the jig are dropped into holes corresponding to the positions indicated by the various scales which are laid out to locate the holes for various types of controllers. In this one jig all the various plates used on K-51, K-35 and K-28 controller cylinders are punched. The hole at each end of the piece is punched separately, the right and left hand sides being adjusted so that the piece is moved first to one side and then to the other. The work is done at the rate of about 1,000 pieces per hour in the V. & O. No. 21 power punch press.

Three different dies for punching gaskets are illustrated in Figs. 9, 10 and 11. The one shown in Fig. 9 is used to punch the bolt holes and the inside contour for compressor cylinder head gaskets after they have been blanked out on another die. That shown in Fig. 10 is very similar and is used for the outside cylinder head gasket. The equipment in Fig. 11 punches engineer's valve gaskets from strips of material in a continuous process. The three rectangular holes are punched in the piece first and the gasket is then blanked out on the second descent of the punch, while at the same time the holes for the next gasket are being made. The punch is made in two parts so that one or the other part may be removed and the tool used for either operation separately. All three of the dies are used on the V. & O. No. 21 punch press.

In Fig. 12 is shown an ingenious arrangement for ejecting a small piece of work after it has been punched out and formed. By thus automatically ejecting the completed pieces the production is very materially increased, as the material is fed in continuously and the

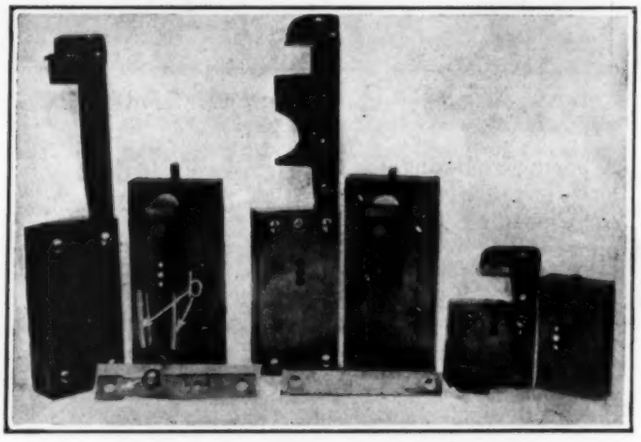


Fig. 13—Dies for controller finger

press operated at top speed. The part manufactured consists of a small brass strip, slightly curved at one end and having a hole punched near the other end, as shown near the bottom of the illustration.

As the material is fed into the die the hole is punched first and the piece is then cut off to the proper length and formed to the proper shape while the hole is being punched for the next piece. The cutting edge is at (*a*) and the forming die at (*b*). After forming, the completed piece is left in the bottom of the die and it is necessary to eject this before the next piece is cut off. As the punch descends, the finger (*c*) enters the opening at (*d*) to force the U-shaped ejector out of the way of the forming punch (*b*). As this ejector is moved back the small spring (*e*) is compressed and the latch (*f*) drops into a notch, thus holding the ejector back in position. While the above action is taking place the hook (*h*) slips below the secondary latch (*g*). The piece of work, in the meantime, has been cut off and formed and lies in the bottom of the die. As the punch ascends again the hook (*h*) trips in turn the secondary latch (*g*) and the latch (*f*), releasing the ejector (*d*), which, under the action of the spring (*e*), snaps the completed piece out of the bottom of the die. The operation is repeated as the punch descends on each stroke.

A group of three dies used for forming the various parts of K-35 controller fingers from strip brass and bronze is shown in Fig. 13. The completed pieces are illustrated at the bottom of the illustration. In addition to cutting off and punching, the die at the left also cuts the outside contour of the piece to the proper shape as shown at (*a*). This cut is made by the cutting edges (*b*) on the punch at the same time that the holes are being made.

How to Estimate Machine Shop Costs

By Albert A. Dowd
Consulting Engineer, New York City

Estimating tool costs—Examples of forms—Methods of handling tool work—Following through an estimate on building a simple fixture—Consideration of assembly

IN ESTIMATING the cost of building tools much depends upon the kind of work required and the routing through the factory. There are several methods in use, in none of which is there a complete time study made, although often a certain operation is figured roughly to obtain an approximation of the time needed. Jigs and fixtures of comparatively small size, boring bars, reamers, special tools of various kinds, forged tools, and so on, are handled without the use of anything except the roughest kind of time study.

Several forms for estimating tool costs are used, one of the simplest being shown in Fig. 60. This sheet contains the estimate number and other important data at the top, while several columns are provided in which tools and costs may be itemized. Additional items, such as patterns, designing, and materials used are "lumped," as shown. Such a form is used by one of the largest contract shops in the country. It is, however, obviously inadequate.

Another Estimate Sheet

In Fig. 61 is shown a detailed estimate sheet used by a large contract shop for tool and fixture estimating. On this form columns are provided for every probable kind of operation, the various tools being listed at the left, while the time for each operation in manufacture is entered in its proper column and totaled as shown. Provision is made for listing the materials under several headings. The sheets are numbered at the upper right hand corner and a summary sheet of simple form is used, for a large estimate, to recapitulate the totals on the various sheets. A similar system was designed to help the production department in routing the work after the contract had been secured, but as the sequence of operations was not given, the sheet was not found to be of as much help as expected. Nevertheless it is valuable as a detailed estimate sheet and there is little likelihood of the estimator's omitting an operation unless he is extremely careless.

Another form, shown in Fig. 62, is similar to the form shown in Fig. 60, except that it is more complete, but it entails very much more writing on the part of the estimator. For rapid work, when the estimator is a man of broad experience, detailed sequence is not always given, or it may be abbreviated and condensed to suit. For example, a boring bar of low grade tool steel would require normally the following operations: Cut-off, center both ends, rough and finish turn, drill, ream and tap holes for setscrews and cutters, mill flats, harden and grind. The cutters themselves would be cut off, turned, shaped, fitted, hardened and ground and assembled. The estimator would often lump several of these operations as follows: c.o. and turn; drill and tap; mill flats; h. and g; make and fit cutters; h. and g.; assemble. Abbreviations are much used on estimates of all kinds.

The form of estimate sheet selected is dependent somewhat upon the nature of the shop and the ideas of the management; any form which is clear and concise

Estimate No. 4784 Sheet No. 1
Customer Argyle Mach. Co., Winifred, Mont.
Name of Part Sprocket Flange Material Steel Cast
B.P. No. A-2161 Date Mar. 7, 1924

No. Reqd.	Name of Tool	Hrs.	Rate	Amount	
2	Boring Bar and Cutter	2 h.	✓	✓	✓
1	Locating Fixture with Clamps	4 h.	✓	✓	✓
1	Floating Reamer Holder	1 h.	✓	✓	✓
1	Special Reamer - shell type 3.214d	2 h.	✓	✓	✓
1	Reamer bar	1 h.	✓	✓	✓
2	Facing tools - h & g	4	✓	✓	✓
			✓	✓	✓
1	Drill Jig with Bushings	4 h.	✓	✓	✓
6	Spec. Reams with ¾" pilots	4 2	✓	✓	✓
6	Special Holders	2 4	✓	✓	✓
6	¾" Twist drills - extra long odex outside				
	Total Labor hours	26 2	✓	✓	✓
	Designing time	40	✓	✓	✓
	Patterns	12	✓	✓	✓
	Cast Iron	46#	✓	✓	✓
	M. S.	50#	✓		
	T. S. (for bars - low grade)	36#	✓		
	H. S. S.	8#	✓		
	Delivery about 6 weeks				

Fig. 60—Estimate sheet of simple form used for tool work

will do, even a plain sheet of paper without a heading. No matter what kind of form is employed, the estimating process in its essential points is the same.

In estimating tool costs we have a number of kinds of tools to consider and also a great variety of machining operations. Many tools are built up entirely from steel, others are of cast iron with steel parts set into or fastened to them, and still others are cutting tools. Then there are gages of different types, templet, snap, plug and indicating, in great profusion and all of them require individual treatment, so that the estimator, to be successful, should be a practical toolmaker, familiar with all the details of the work. A much more experienced man is required on this kind of estimating than on contract work for production of duplicate parts.

Factors which we have not previously mentioned must be considered, such as setting up work for a single

This is the eighteenth article. The seventeenth was concluded on page 1,000, Vol. 61.

piece; obtaining accurate measurements by "buttoning up" a jig or fixture; laying out the work previous to machining; scraping and fitting; processes of lapping, etc., etc. The allowances needed on many of these items can be estimated only by a man who has actually built tools and who knows that certain steps are necessary in the procedure. Another point of importance is the difference between workmen, and the fact that when two men are given the same work to do, one will quite possibly produce the work in much less time than the other.

Let us consider some of the most important points which affect the estimating of tool costs, and also the various items which must be included in the estimate. We may have either of two conditions: (a) an estimate is to be made from a completely designed and detailed drawing of the tool; (b) a rough sketch of the tools required must first be made and the estimate made from the sketch. Assuming that tools have been designed and detailed, the estimator must consider the making of one or more patterns; the various operations in machining the casting or castings; the making of steel parts or other components; the fitting of these to the tool; the grinding or lapping of bushings or surfaces; the scraping of surfaces where a sliding fit is required; the assembling and testing of the tool; the amount of material of different kinds used; the current prices for these materials; the cost of labor; the margin for profit.

Estimate No. 1624 — Detailed Estimate — Sheet No. 1
Customer Sayer Railway Appliance Co. Berge, Mich.
Name of Part Switch Control Body — Material C. I.
B.P. No. R-1326 — Date 4-8-1924

Name of Tool or Fixture	No. Reqd.	Labor Hours: Clean	C.O	Plane	Mill	Turn	Drill	Bore	Ream	Thread	Hard	Grind	Fit	Assbl.	Dwg.	Pats.	Forge	Material, Pounds: C.I.	M.S.	T.S.	H.S.	Cost: Net	Cost: List
Mill Fixt. Body	1	.25		6	4		3	1	.5				4	3		4		30					
Locat. Plug	1		.25			2				1	.2	.5		.5					4				
V-block	1		.2	2			.5			.3	.2	.6		.5					1				
Clamps	3		1		1		.7				.5			.5					9				
Studs	3		.5							.5	.2			.3					1				
Drill Jig Body	1	.2		10	6	-	4	8	4	.5			6	4		6		20					
Bushings	10		.5			2.5	2	2				2		2						3			
Loc. Plug	1		.25			2				1	.2	.5		.5					4				
V-block	1		.2	2			.5			.3	.2	.6		.5					1				
Totals		.45	2.9	20	11	6.5	12.7	11	4.5	3.6	1.5	4.2	10	11.5		10							

Total Labor Hrs. 102.15

Remarks:- Delivery - about 5 weeks after receipt of order
Patterns to become property of customer.

Fig. 61—Detailed estimate sheet for tool work

We shall not go into the matter of overhead costs, as this is a function of the cost department. It is important to note that some factories use different rates per hour for different kinds of work. Others consider all toolmaking work at a fixed rate per labor hour. When several rates are used the estimate summary should separate the items according to the different rates. Many factories have a fixed overhead rate for certain kinds of work, the amount per hour being sufficient to cover normal profit. Others add a certain percentage to the cost of labor and another percentage to material costs to cover the handling. In either case the estimator makes his estimate in the same way, leaving the sales department to figure out the percentages according to the system employed.

The methods used in the manufacture of tools and fixtures are dependent largely upon the amount of work handled and the tool room equipment. If some of the components of a jig or fixture are made up in different departments and afterward sent to the tool room for final fitting and assembling the work is quite likely to cost too much even under the most favorable conditions, as an excessive amount of fitting is often required. Planing and shaping operations can sometimes be handled in another department, and the machining of bushings also, but the majority of jig and fixture parts are usually less troublesome if made up under the supervision of or directly in the tool department. Otherwise very close limits in machining will be found necessary, as well as careful supervision to avoid errors.

Some of the best tool work the writer has seen and the most reasonably priced, is almost completed in a single department. Planing, shaping, turning, boring, drilling and milling operations, all are carried on. For work of extraordinary size, the planing is done in the regular planing department, but all jig and fixture work up to about 12x15 in. is completed in the tool department. The workmen are specialists, some on planers others on lathes, milling machines and so on. There are some men who simply lay out and prick-punch the work and others who do nothing but the assembling and fitting. It is surprising how rapidly work goes through the department and how little trouble there is in assembling. One man is in charge of the routing of the work through the department, and follows it up in process. Some system similar to this is an essential element in good tool-room work, particularly when the work is done at flat prices.

Let us follow through a simple example of tool estimating, noting the requirements and allowances made for the various operations and applying the knowledge gained in preceding examples. Fig. 63 shows a very plain milling fixture to be built in good, commercial style and within reasonable limits of accuracy. The job consists of base *A*, locating stud *B*, C-washer *C*, stop *D*,

set-screw stud *E* and two keys *F*, for locating. Pattern, castings and all materials are to be included in the cost estimate submitted. A detail drawing of the work to be held in the fixture is given, as a matter of reference.

The first step in the making of the fixture would be a pattern shop job for the body of the fixture. A very simple, plain, pine pattern without cores would be sufficient, as only one casting is required. The making of pattern estimates is outside of machine shop work and will not be discussed. It is customary to let the "boss pattern-maker" give an estimate on the time. Assume that he estimates 3 hours on the work in question.

The weight of the casting is approximated by finding the number of cubic inches in the body and multiplying the amount by 0.26 lb., the weight per cu.in. of cast iron. With normal finish allowances the volume is about 88 cu.in., the weight 23 lb. Allowance is made for 30 lb. of cast iron, at a price determined by quotations on similar work at the time when the estimate is made.

The body must be planed on the bottom and across the top and also on the surface against which the work rests. The key-slot must be cut accurately to size. By applying the knowledge gained from the planing examples, the piece is estimated as a three-setting job. The base and key-slot would be planed longitudinally, the other surfaces would be cross-planed. A reasonable allowance for the work would be 4 hours.

The locating stud hole would be layed out, prick-punched for location and bored. While this was being done the two holes in the ears would be located and prick-punched. In boring the hole, a milling machine would probably be used, and in the same setting the two ½-in. holes would be drilled and reamed. One of them requires accurate location, because a stud is to be placed in it to act as a side stop for the work. The boring of the hole for the center stud should not consume more than 2 hr., including location.

The hole for stud *D* could be located with sufficient accuracy by dropping the table the correct amount and using the dials to obtain the proper spacing. The hole on the other side could be obtained in the same way but need not be located as accurately as the other. An allowance of 5 hr. for the three holes should be sufficient to cover laying-out and setting-up.

While still in the machine it would be advisable to reverse the work and face the back of the boss with an end mill or counterbore. A half hour extra would be sufficient. Nothing would remain to be done on this piece except the drilling and tapping of the ⅝-in., 18 pitch holes for the key screws, a job that would be done during assembly on a drill press of the sensitive type and which would not take over another half hour.

The next piece is the locating stud *B*. It does not need to be discussed in detail, except to note that it is threaded at both ends and ground on two surfaces. Two hours should be sufficient for turning and threading. An allowance for grinding must of course be made in the usual manner and the grinding time itself would be about one hour.

The weight of the material, considering finish allowances, would be the weight of a piece of steel 1⅛ in. in diameter by 7 in. long, or 1.81 lb. Allow 2 lb. at the current price. The set screw stud *E* is made from square cold-rolled steel, turned and threaded at one end and tapped for a ⅜-in. standard screw. The piece would not be carefully estimated. Allowances would be 1½ hr. for making it and 1 lb. of cold-rolled steel would be used.

Estimate No. 5760 Tool Estimate Sheet No. 1
Customer Bland and Smith, Minneapolis, Minn.
Name of Part Side Rod Bracket Material Bz.
B.P. No. S-462 Date 4-12-1924

Name of Tool or Fixture	No. Reqd.	List of Machine Operations	Labor Hrs. Mach. Work	Pats.	Dwg.	Material Lbs. C.I	M.S.	T.S	H.S.	Remarks
Drill Jig Body	1	Plane, cut keyways	8	4	12	12				
		Bore and ream holes	5							
		Drill and tap	2							
		Fitting and assembling	6							
Drill Jig Leaf	1	Make from M.S. Plate	6				4			
		and shape to size								
		Locate on plate and	12							
		bore bush holes								
		Drill and ream for latch	2							
		Fit to body	1							
½" bushings	4	Rough out on hand sc.	4					1.5		
		machine on lathe								
		Harden, grind and cap	3							
		Assemble in Leaf	.5							
.750 bushings	2	Same as above	6					1		
Clamps	2	C.O. from flat stock	.5				2			
		Shape to size	2							
		drill	1							
		harden	.5							
		Totals	59.5	4	12	12	6	2.5		

Summary, Labor Hrs.

Machining Hrs.	59.5 @ 1.50	89.25
Patterns -	4 @ 2.00	8.00
Drafting -	12 @ 1.25	15.00
Total labor Costs		$ 112.25

Summary, Materials

C.I Lbs	12 @ 10	1.20
H.S. -	6 @ 8	.48
T.S. -	25 @ 20	.50
H.S. -	None	

Delivery: 3 weeks from receipt of formal order and sample plate for B.P.

Total Matl $ 2.18
Total Est $ 114.43

Fig. 62—Form of estimating sheet permitting considerable latitude in making tool estimates

The stop *D*, of drill rod hardened and ground to size, would be made oversize for a drive fit. The piece would be ordered longer than required to give room for a dog in grinding and would be broken or cut off to approximate length afterward. One hour would be sufficient for making this piece. For the two keys *F* and the C-washer 2 hr. and 1 lb. of steel would be allowed.

All the parts being made up, the center stud would be put in place and a nut and washer used to draw it up tight against the face of the angle. The stud *D* would be forced into its hole under an arbor press and the set-screw stud *E* would be assembled by using a nut and washer. The keys *F* would be put into place and the C-washer drawn up against the end of the locating stud with a standard nut. The fixture would then be finished, ready for testing.

For the assembling, brushing up rough corners with the file and small matters of fitting, 4 hr. would be allowed as a safeguard. The total time for machining and fitting, not including pattern time, would then be 21½ hr. It would be wise to allow about 30 hr., including the pattern time, if pattern time is quoted at the same rate per hour as the machining time. If quoted at a separate rate, the allowance would be 26 hr. for machining time and 4 hr. for pattern time. The summary of labor costs plus the costs of the material to be used would give the estimate figure wanted.

The delivery date should always be given on an estimate and it depends very much on the condition of the shop and the priority of other orders. Ordinarily a job of the kind described would go through the shop in about two weeks, which would allow time enough to get the pattern and the casting made.

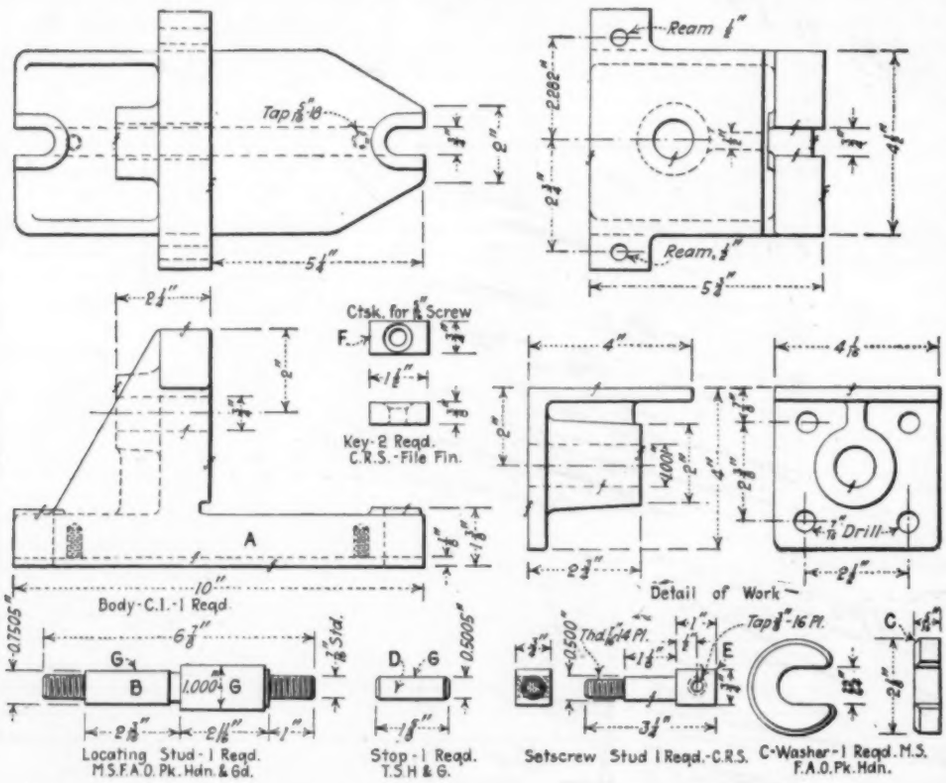


Fig. 63—Example of fixture on which estimate is to be made

Allowances for Fitting

The example illustrates tool work involving the use of patterns, but there are many fixtures built up entirely of steel and in making estimates on them the estimator must not forget that planing, shaping and finishing operations require considerably more time on jig and fixture work than when production estimates are being made. The majority of built-up jigs are hand polished after completion by using emery and oil, crocus and other compounds. Corners are chamfered or slightly rounded so that there are no sharp edges to injure the hands of the operator. Considerable time is consumed in these operations and the estimator must make some allowances to cover it.

Fixtures which have sliding members, such as slide tools, taper-generating fixtures, and other similar devices, have their sliding parts scraped to a fit and the estimator who has not had practical experience on that class of work will find himself at a loss for data. The safest method of estimating which the writer knows is to collect as much data on work previously done as possible and then when a job is received select the nearest similar piece as a guide in specifying the time required. Be sure to make the allowance ample to cover contingencies.

Assembly is another phase of the work on which no absolute data are available, due to unknown conditions in the shop and very decidedly to the human factor. The quality of the work turned out is also to be considered. Given uniform and accurate component parts to be used in a fixture, two men assembling the parts will vary greatly in the time consumed, yet the work may be equally good. On a piecework or premium-system basis, this may not make so much difference, but on an hourly-rate basis much money can be lost in the assembling process. Parts produced within specified limits and accurately finished surfaces are a great aid in reducing the costs of assembling. The best method of estimating is to imagine yourself doing the work, jotting down the time allowances for different parts assembled and then after doing this add the items together and to the sum add from 30 per cent to 50 per cent for the difference between your speed and the other man's.

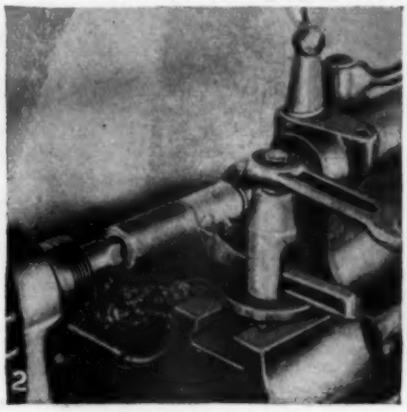
Often the construction of a jig or fixture requires that certain holes be put in at assembly in order to ensure proper alignment with other members. In such cases the assembler becomes a machine operator for the time being. Do not forget to include such items in the estimate.

The location of bushing holes in a jig or fixture is another problem for the estimator. If work is done on a lathe face plate, using the "button" method, time must be allowed for laying out the holes, drilling and tapping them, applying the buttons and setting them. Then each setting of the work and indication of the button must be considered, as well as the slow boring to size of the various holes. No fixed rule can be given for such work.

Allowances for Boring Jig Bushing Holes

When jig work is done on a milling machine, several methods are possible in locating holes for boring: the button method, using a plug and sliding sleeve; the size block and feeler method; and the setting for distances by means of special micrometer or vernier attachments on the machine. The accuracy required may determine the method to some extent and the estimator must make his allowances according to the method most likely to be used.

(To be continued)



Piston Pins from Bar Stock

Photographs by courtesy of John W. Leahy, Danbury, Conn.

Fig. 1—Rough drilling and cutting off

Fig. 2—Turning outside of pin

Fig. 3—Rounding the ends

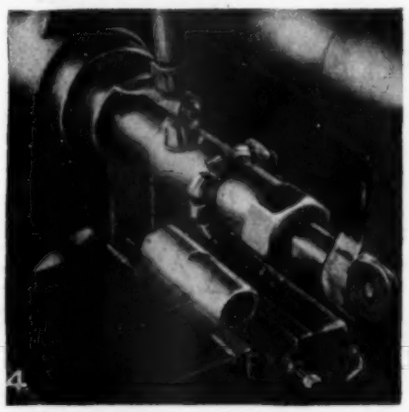


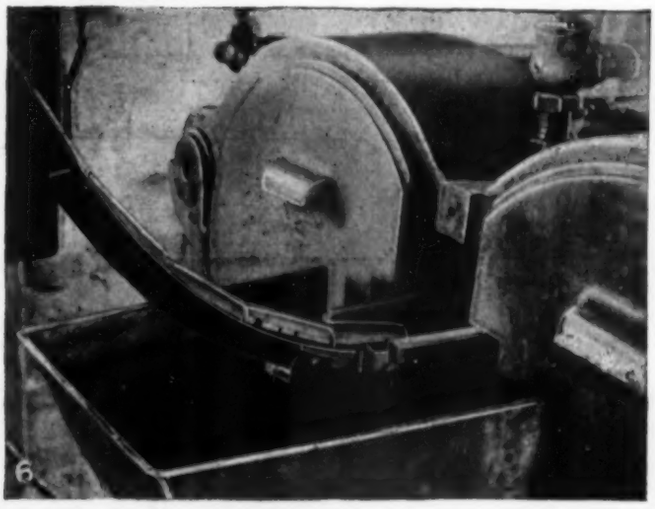
Fig. 4—Milling for clamping screw

Fig. 5—Heat treating

Fig. 6—Grinding on centerless machine

Fig. 7—Gaging, inspecting and sorting

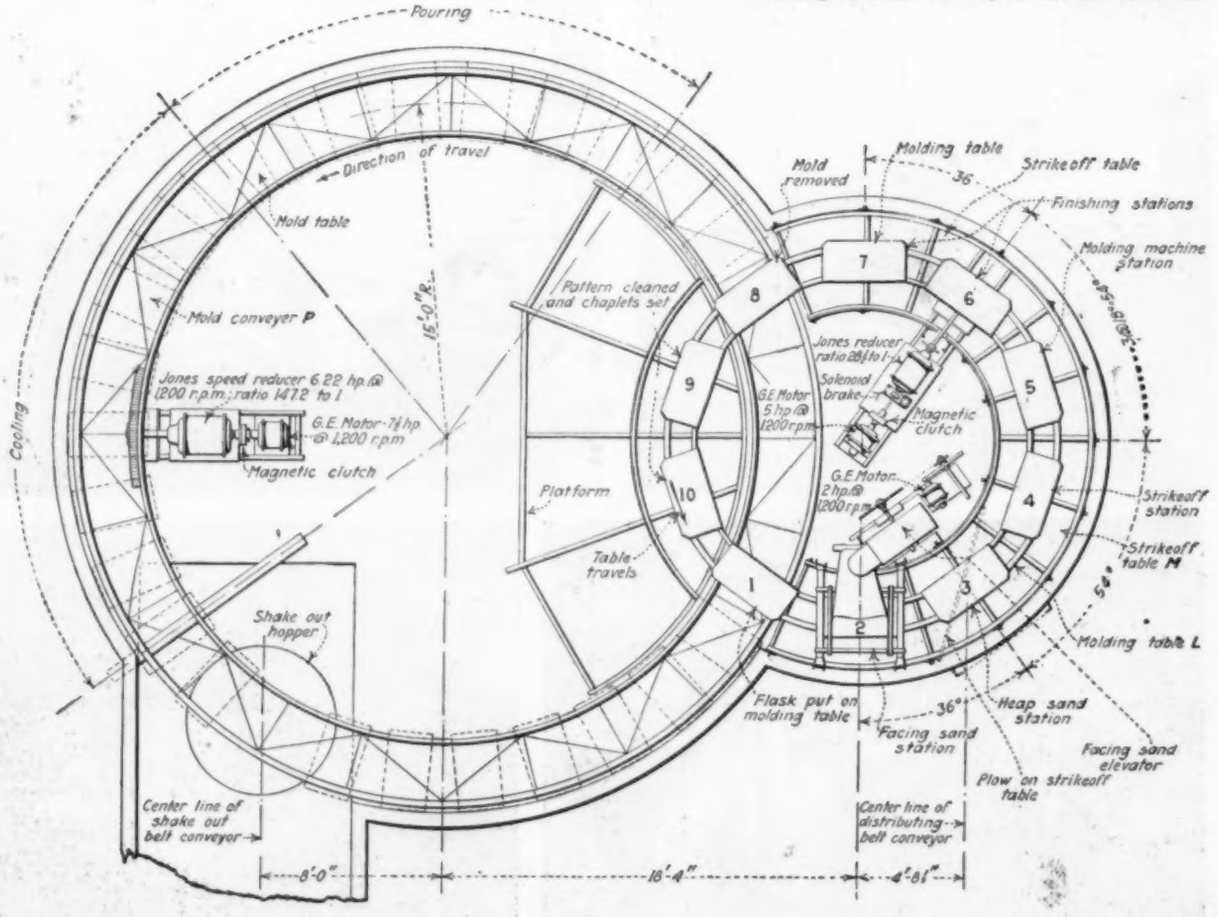
Fig. 8—Marking ends to denote size



Foundry Work Without Drudgery

Fig. 1—Mold Conveyor, 30 ft. in diameter, travels intermittently 3 ft. every 2 minutes. Fig. 2—Plan of conveyor and sand preparing unit

Photographs by courtesy of the Link-Belt Co.



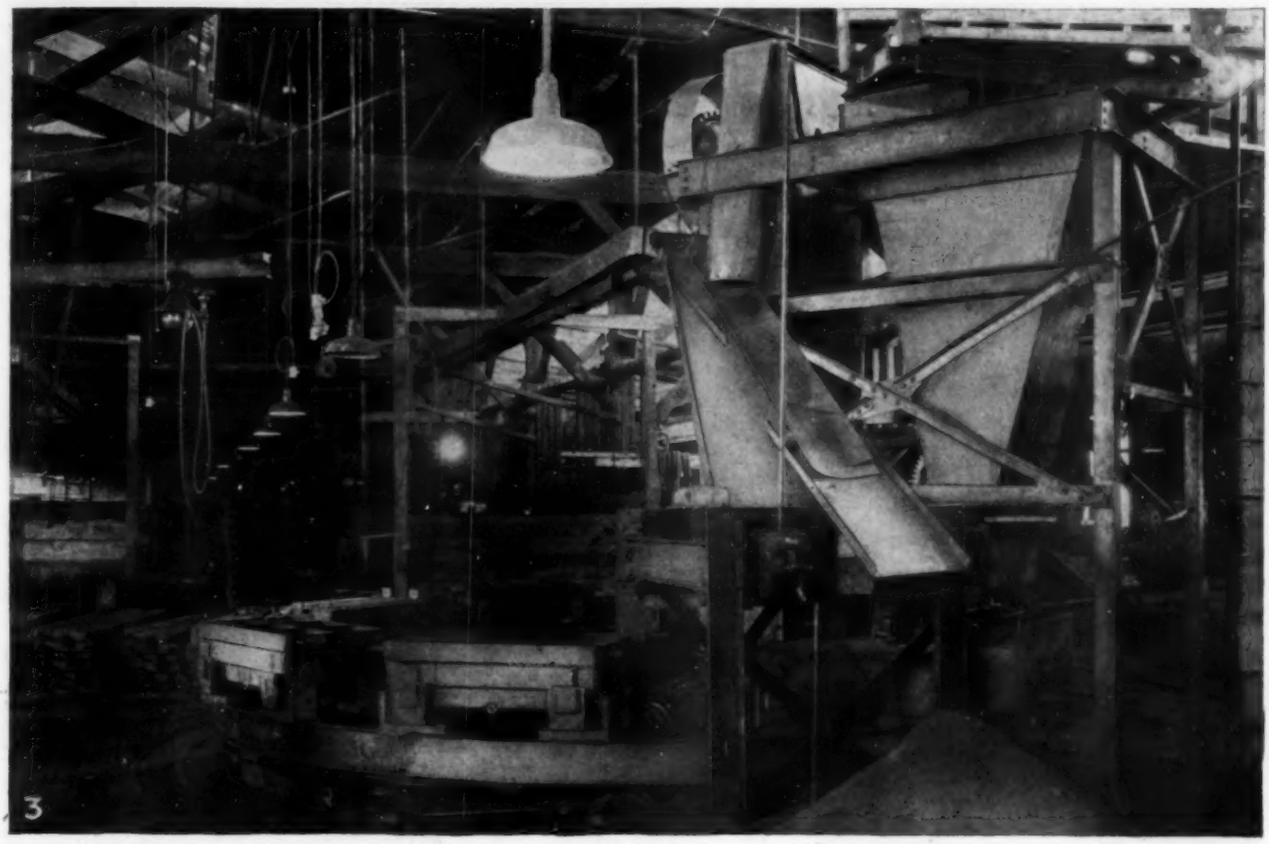
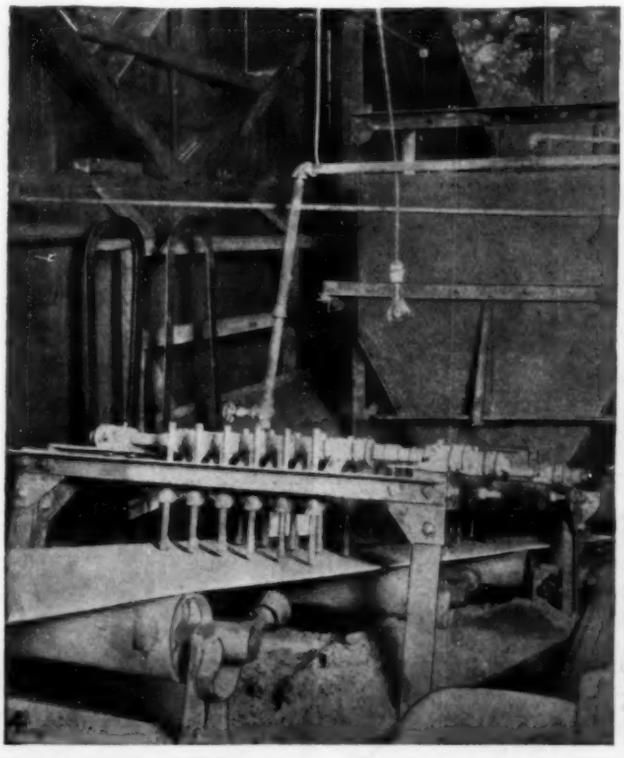
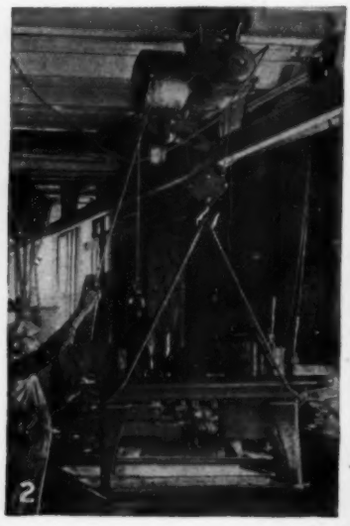
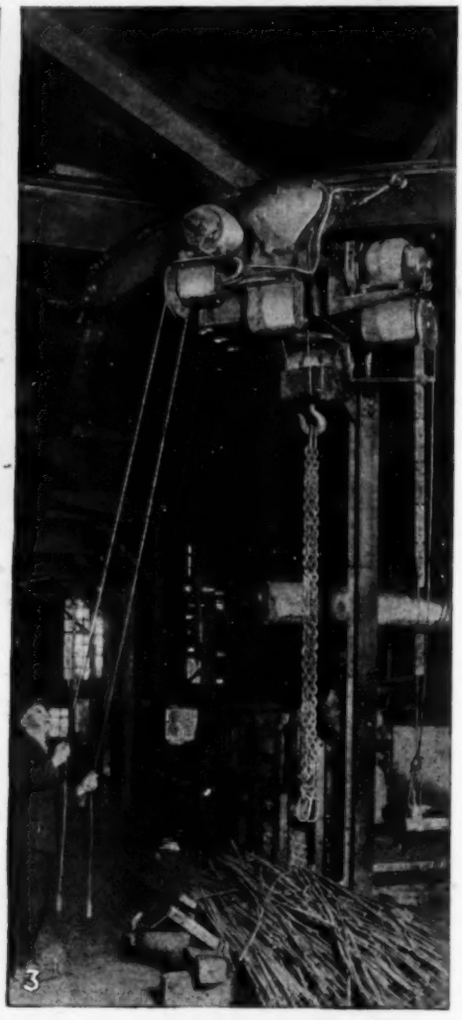


Fig. 3—Molding table, 15 ft. in diameter. Belt conveyor delivers to hopper flask. Elevator handles strike-off sand from table of same diameter directly beneath molding table. Fig. 4—Rakes over tempering belt conveyor. Fig. 5—Head end of sand-tempering belt-conveyor







Helping Men Handle Work

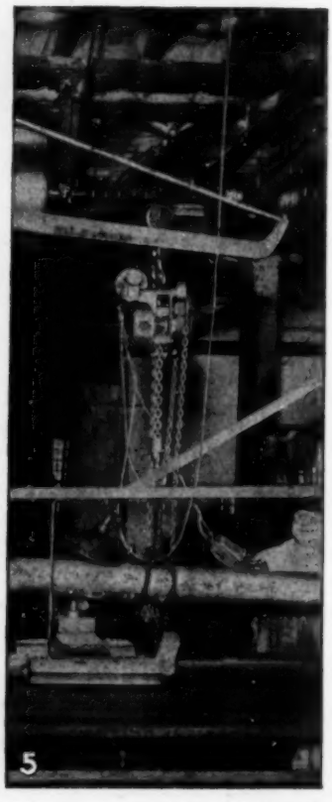
Fig. 1—Erecting steam-pumps with the Shepard motor hoist

Fig. 2—Shepard motor hoist used in packing screw machines

Fig. 3—Euclid motor hoist in the heat treating room

Fig. 4—Motorbloc hoist used in assembling shapers

Fig. 5—Handling printing-press roller with a Motorbloc



Making Housings for Ball Bearings

Special Correspondence

Preliminary grinding operations—Simple fixtures used—Special boring bars and cutters—An ingenious setting gage

TO GET the best results from ball-bearings, whether they are used to support long line shafts or shorter countershafts, it is advisable to mount them in housings specially designed and constructed for the purpose. To insure long and satisfactory service the outer ring of the ball-race should be confined securely against the possibility of vibration and yet not held so rigidly as to prevent it from adapting itself to slight changes of position that may be made necessary by the expansion and contraction of the shafting.

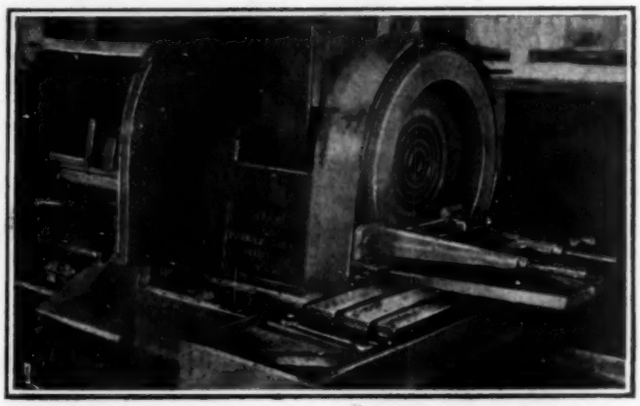


Fig. 1—Grinding bearing pads of hangers

Though held tightly enough so that it will not rotate under ordinary conditions, there should be just sufficient latitude in the grip to allow the outer ring to creep around slowly; possibly but a few revolutions per day or week, but still enough so that the wear will be distributed evenly over the entire circumference of the outer ball-race.

The manufacturers of SKF ball-bearings have a plant at Hartford, Conn., that is completely equipped to produce housings for SKF bearings for any purpose to which such bearings are adapted. These include hangers for overhead shafting, pillow-blocks and pedestals for wall or post support and special shapes designed to be incorporated into machines the several shafts of which are intended to be run on ball-bearings.

It is an essential feature of work of this nature that the castings used should be so designed as to require as little machining as possible. Shaft hangers have two long studs cast in them, as may be seen in Fig. 1, and each stud is fitted with three substantial nuts. Elongated holes in the ears of the bearing housing corresponding to these studs allow the housings to slip over them, and they may be adjusted for height by setting the nuts above and below them and also for side adjustment by the set screws in the ends of the ears.

The only machining required on the hangers after they are cast is to dress the pads where they bear against the supporting surface of ceiling or beam from which they are suspended, and this work is done upon a No. 8 Badger ring-wheel grinding machine. A large plate is clamped to the table of the machine, having a number of holes tapped into it in which studs may be set in whatever positions may be necessary to accommodate the various sizes of hangers to be ground. Locating and holding blocks are clamped to the plate wherever required. When the blocks are properly placed the hanger is laid upon them and fed up to the grinding wheel by the screw and handwheel movements of the machine. The weight of the casting is sufficient to hold it in place without fastening of any kind.

The mating surfaces of the housings are ground in much the same way, and equally simple fixtures are used. The operator shown in Fig. 2 is grinding the face of a special machine housing that is to hold two ball-bearings and the fixture he is using is merely a block, roughly shaped to conform to the contour of the casting and bolted to the vertical face of an ordinary angle-plate on the swinging table of the machine. The machine is a Gardner disk grinder.

The lower members of pedestal housings are usually planed as shown in Fig 3 by mounting them in gangs upon the table of the planer. No fixtures other than standard planer bolts, straps and stops are needed.

Drilling operations upon the caps of pedestal and hanger housings are illustrated in Figs. 4 and 5. The first machine was originally a standard 3-spindle drill-

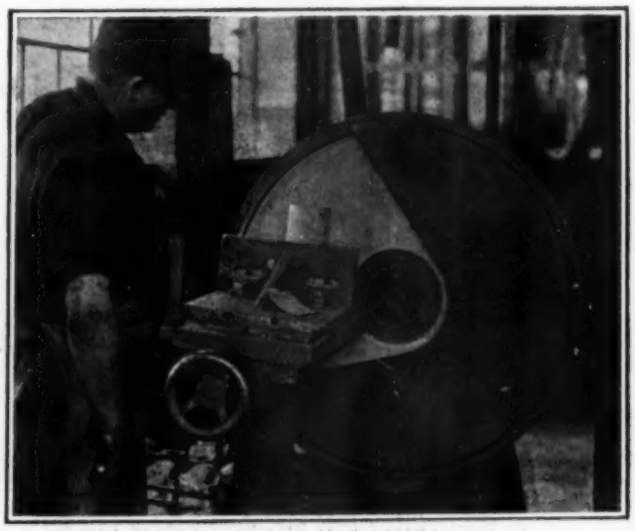


Fig. 2—Grinding face of bearing housings

Fig. 3—Planing pedestal bearings

press, but the central column has been removed to give more room on the table. The spindle to the left is drilling an oil hole, and the work is merely set over a couple of studs in the face of a 45-deg. angle plate. The fixture to the right is a 90-deg. angle plate to the face of which

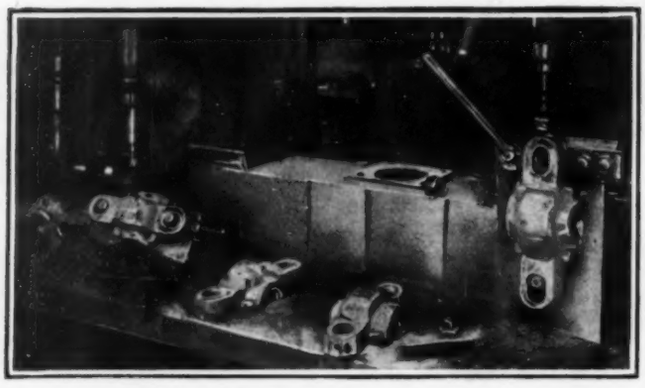


Fig. 4—Drilling holes for oil and for adjusting screws

a fixed jaw and a lever-operated movable jaw are attached. A stud in the face of the plate enters the large bolt-hole in the lower end of the work and supports the latter against the thrust of the drill. Fig. 5 shows a standard multiple drilling machine set up to drill four

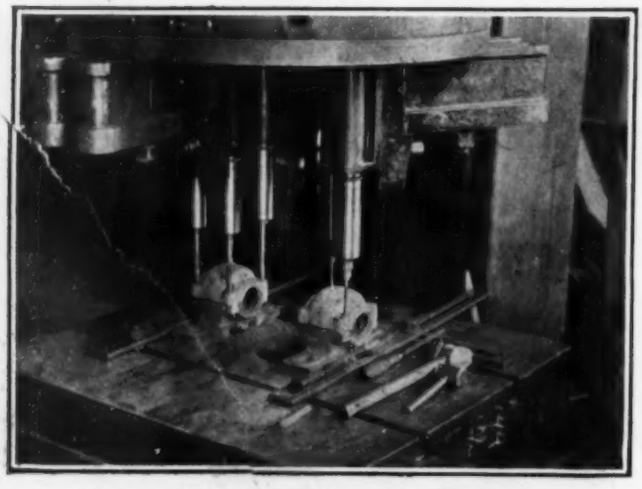


Fig. 5—Drilling bolt and dowel holes in caps

bolt holes and two holes for dowels in another form of cap. The drilling machines are equipped with power feed and one operator attends them all.

Boring the interior of the housings is done by means of special boring bars, swung either in a standard milling machine or an engine lathe as the exigencies of the work may demand. Figs. 6 and 7 show the set-up in the former and Fig. 8 in the latter. Two bars are used in each case.

When the housings come to this job they have been drilled and tapped for the cap bolts, but the bolts are not in place. There are, however, two substantial

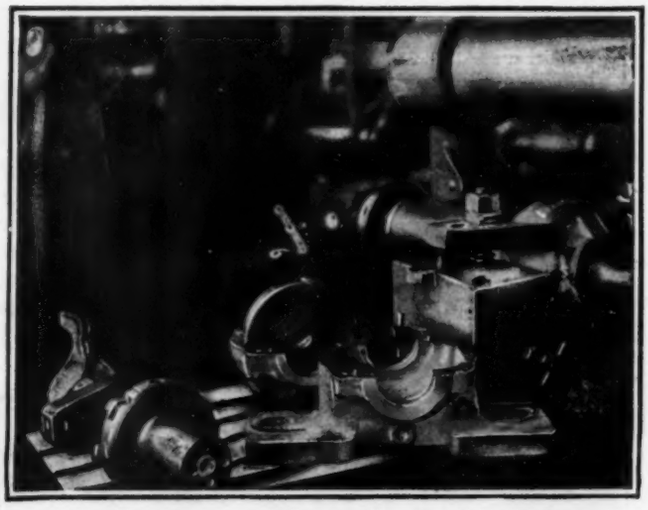


Fig. 6—Fixture, boring bar, and operator's gage

Fig. 7—Showing the bar in the housing

dowels in each housing, and each housing and its cap bear an identifying number that was put on at the time the housing was transfer-drilled from the cap.

With the housing in the fixture shown in Fig. 6 and held together—as well as held down—by the straps, a plain bar is used to bore the clearance holes for the shaft. The diameter of these holes is larger than the nominal diameter of the shaft that is to go in them by a definite amount and there is in each a cast recess to hold a felt washer, the duty of which is to retain the oil and prevent it from spreading along the shaft and to exclude foreign matter when the bearing is in service.

When this job is finished and one side of the housing

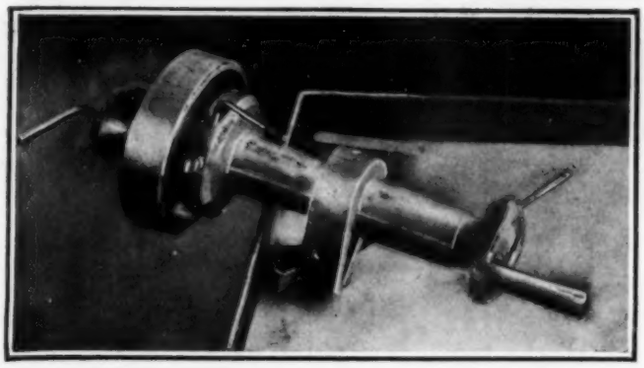


Fig. 9—Boring bar and setting gage

is faced by a sweep cutter in the bar the straps are released, the cap taken off its dowels without disturbing the other casting and the boring bar exchanged for the one to be seen on the table of the machine in the same picture. This bar carries an arm in which is located the sweep cutter for facing the remaining end of the housing, and a boring head with an accurately adjust-

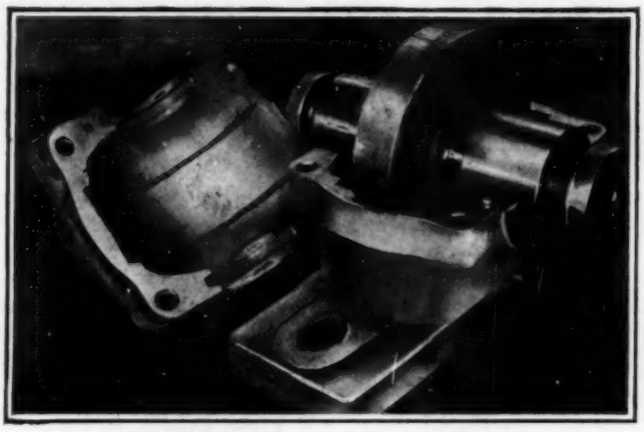


Fig. 10—The inspector's gage

able tool for boring the internal diameter. Fig. 7 shows the bar between centers of the milling machine before the cap is put on, and Fig 8 shows the same outfit in an engine lathe.

The bar is shown separately in Fig. 9 with the setting gage by which the diameter of the bore is determined. The gage is a steel disk having a hub extending

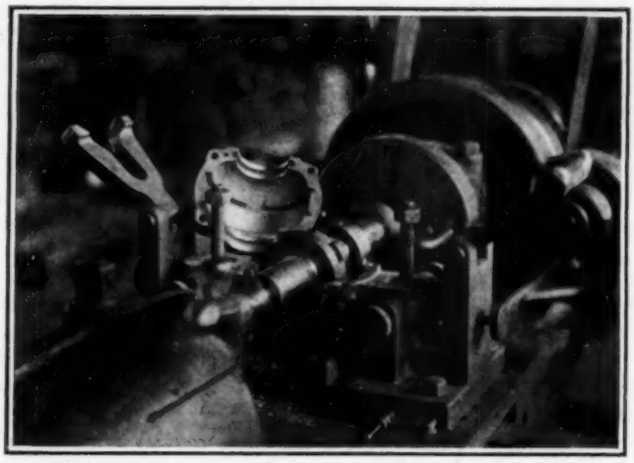


Fig. 8—Boring housings in a lathe

to one side and in the other side is a large counterbored recess of the same diameter as the bore of the housing. It is hardened, and both bores are carefully ground. The smaller bore fits the diameter of the bar closely—in fact it is a wringing fit—while the larger bore passes over the boring head and point of the tool.

The tool point is set out by a wedge, operated by a hollow head screw (shown in the illustration with a wrench in place) in the end of the bar. A similar screw

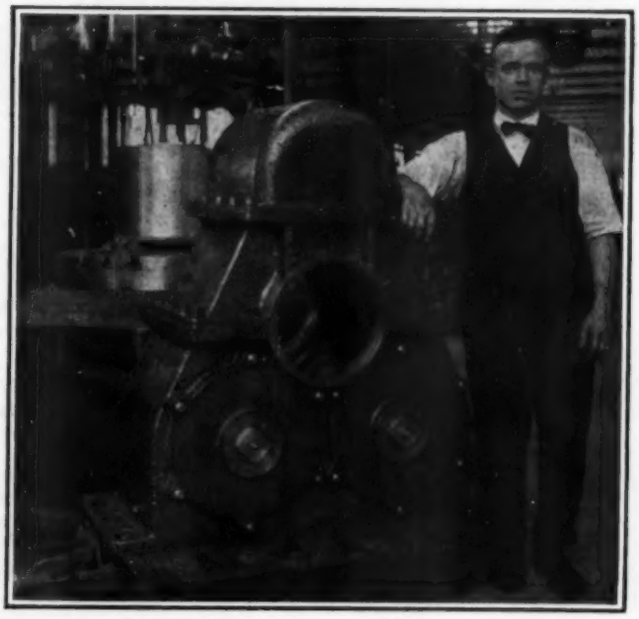


Fig. 11—Housing for a centrifugal casting machine

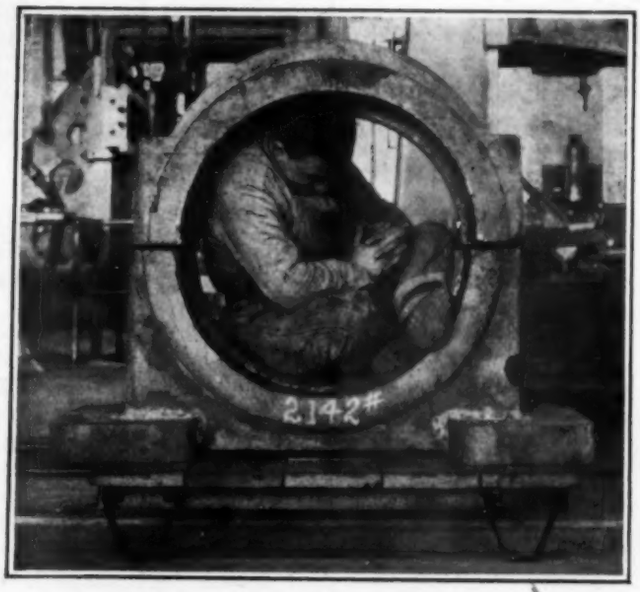


Fig. 12—This housing is for an Army dredge pump

in the periphery of the boring head binds the cutter. To set the tool the gage is moved forward on the bar until the recess comes over the point of the tool, the latter is set out until it touches the inner surface of the recess and is clamped by its binding screw. The gage is then removed from the bar.

The inner diameter of the housing is held to very close limits. A gage for the operators may be seen in the housing on the table of the milling machine in Fig.

6, and Fig. 10 shows the inspector's gage. This latter gage is made of tool steel and is hardened and ground on all its essential diameters. The disk is permanently mounted on the arbor while the pieces at either end are bushings, ground in the bore to fit snugly on the arbor and on the outer diameter to the size of the clearance holes in the sides of the housings. The knurled knobs at the ends of the arbor are merely for convenience in handling the gage and are screwed on.

To inspect the completed housing the gage is set in place, the cap put on and the cap-bolts screwed down tightly; under which condition the inspector must be able to rotate the gage by turning the knurled knobs, but the disk must fit the large bore closely enough to leave evidence by transferring to the cast iron some of the oil color that has previously been rubbed upon its surface.

This test assures not only accuracy of diameter but of alignment as well. If the larger bore did not line with the smaller one the disk could not be turned—whether it fitted or not. If the central bore was too large the bushings would be loose, while if too small the caps would not go to place.

Most of the operations described are those performed on the smaller pieces produced in the plant. That larger work is also put through will be evident from Figs. 11 and 12, which show examples of various types of large anti-friction bearing housings. The one shown in Fig. 11 contains three rollers that support a centrifugal casting machine, the two lower ones carrying the weight and the upper one keeping the shaft from jumping. There are two bearings on each roller and the rollers run at 437.5 r.p.m.

The housing shown in Fig. 12 is one used on a big centrifugal pump in the U. S. Engineer Corps dredge "C. B. Harris." The pump is driven by a 1,000-hp. oil engine.

Showing Details of Competitor's Work—Discussion

By R. E. Marks

It seems to me that in the discussion under the title given above on page 984, Vol. 61, of the *American Machinist*, John Homewood omits an important point.

My friend who hesitated to send his blueprints to form exhibit 954 in the machine-tool builder's file, would not at all mind being referred to as a user of the XYZ machine or service. He would also be glad to have Dr. Jones point with pride to him as a star patient. But he wouldn't exactly fancy having the aforesaid doctor broadcast the information that his left hypogastrium was held in place with a shoe horn, or that he inherited the seven-years itch from his grandmother.

I agree heartily that it is foolish to try and keep shop secrets these days and that the real progressive manufacturer means to keep at least one jump ahead of his competitors. But here again there is another side to the question. It could very well happen that my friend's blueprint, exhibit 954, should be shown to a competitor before the machine or method was in operation. He'd have to be some rapid "progressor" to keep ahead of the game under such circumstances, although I admit such a rapid follow-up is not usual or likely.

It is not a question as to whether the machine-tool builder should tell who his customers are, or that he is saving them real money. That is strictly ethical and proper. But should he show a detail of his customer's machine and tell just how he handled the job without said customer's consent, any more than the doctor should discuss his patients by name and tell just how many times he's saved them from blindness on account of poor hootch?

Rule by Rule

By Entropy

Out of a hundred executives, there is usually a pretty even division between those who frankly admit that they handle their business by rule, and those who equally frankly admit that they take each problem as it comes up and settle it on its merits.

Of course, every business man has some rules, perhaps not printed but abided by nevertheless. When a man first hires one other man to work for him, he makes rules about shop or office hours and he abides by his own rules better than he can ask his "Help" to do. When he has thousands of men working for him, he has some rules, but probably not all of them are printed. Some men govern all their relations with their employees by rule, while others say that their employees are human like themselves, but no matter how much they try to treat each case as an individual one, they find themselves establishing precedents, and precedents are only rules petrified in place.

Most of us who work for others would like to have all our problems treated as individual ones—except those that have been settled in our favor in past cases. After all, we all like to know before we begin a job how our work is to be judged. If we are running a lathe we like to know the limits within which we are to work. Likewise we like to know how long it has taken other men to do the same job. If we are designing new machinery we like to know exactly what our goal is. We want to know what the other firm's machine produced. Then we have something to aim at, but we like also to know that other designers labored under the same or as severe restriction as we have to.

An athlete comes to the starting line, knowing how far he is to run. What if the starter told the contestants to run until someone fired another gun? No one would want to race, and yet half the men who work for a living do not know the goal for which their employers think they should be aiming. We can go a step higher. A man is engaged by a firm as an industrial engineer. He is left, more often than not, to find a place for himself in the organization. The shop has been going on for thirty years without anyone of that title. Tom, Dick and Harry and a flock of their cousins are each doing a little bit of what the new incumbent thinks is his job. Some of them surrender their bits to him with alacrity, not to say haste. Others adhere to their parts with all the tenacity of men who see their jobs being detached bit by bit.

The industrial engineer slips into his work along the line of least resistance, which means that he does the easy parts that anyone can do, and which anyone had done, but he does not get a chance to do the work at which he could earn his salary. It is not his fault, it is the fault of the management which did not carve up the turkey, but invited the stranger to come in and help himself to what was left after the family had gorged itself.

Ideas from Practical Men

A Universal Clutch-Milling Fixture

By Chas. G. Pfeffer

Fixtures for milling positive-tooth clutches are usually designed to operate on one type of clutch which it is possible to manufacture in large quantities. They, therefore, come within the class of tools that are special for that one particular piece. The type of clutch it is possible to cut with the fixture here described, covers considerable range.

The product of the plant where this fixture was built requires a large number of positive-tooth clutches of various dimensions. The question of a fixture to facilitate the machining such clutches has been given considerable thought, the design here shown having been finally approved. The fixture had to be adaptable over considerable range, as the height, bore and number of teeth varied. It had to be made within a specified cost,

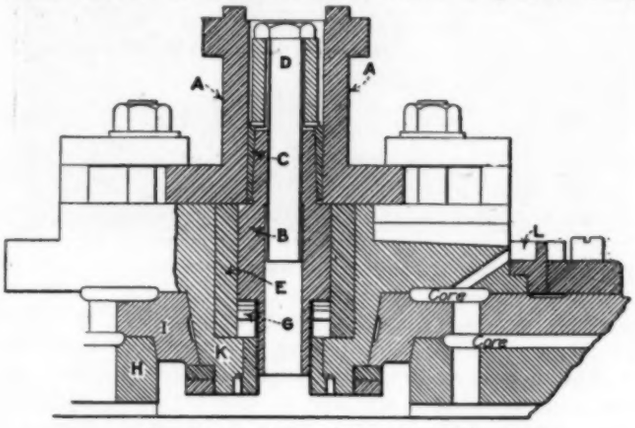


Fig. 1—Sectional view of clutch-milling fixture

the number of clutches used per year not permitting expenditures above a certain amount. It had to be rigid and solid, as most of the teeth cut are small in number and usually cut to the full depth at one pass of the cutter. Ease of operation and elimination of error, using ordinary precautions, also had to be considered.

A cross-section of the fixture is shown in Fig. 1. *A* represents the piece in which the clutch teeth are to be cut. The part is held and centered from the bore by the arbor *B*, insuring proper alignment of the teeth. The arbor also takes the thrust of the cut, being fastened down solidly by a thread at the lower end. The part to be cut is held by the split bushing *C* which has a slight taper on the inside to fit the arbor. The split bushing is expanded by the tightening of the bolt *D*. *E* is a spacing bushing for the various sizes of arbors, and at *G* are washers to adjust the height of the arbor with relation to the top of the fixture, so the bushing may be shortened for cutting shallow clutches.

Part *H* of the fixture is bolted to the milling-machine table. Part *I* swivels on the base carrying part *K* with it. ~~Part~~ *K* swivels on part *I*, being the section that indexes the work when *A* and *I* are bolted together.

It will be noted that the top of the faceplate *K*, is flat and nothing of the mechanism of the fixture projects above its surface. This makes it possible to place work on the fixture of such diameter as is permissible by the range of the milling machine, making it practical to cut teeth clutches of large diameter. Owing

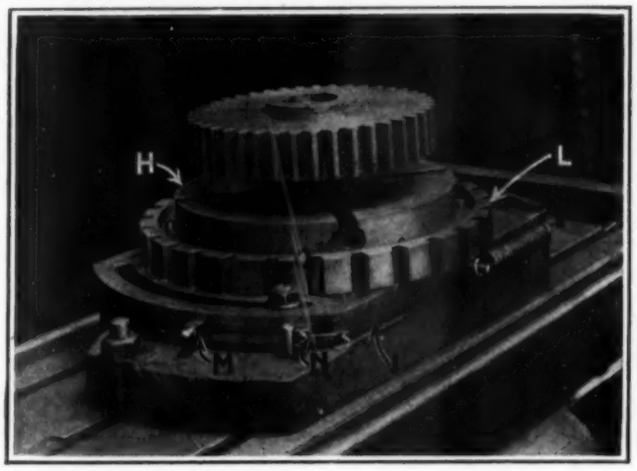


Fig. 2—Clutch-milling fixture—Left front

to the variations of the diameter of the work to be machined, it was decided to eliminate the chip and oil pan. For carrying off the compound, the cores shown in Fig. 1 were arranged so that the compound would run down into the groove in the indexing ring *L*, thence through the angular holes into the core between parts *K* and *I*, down through the holes in the base, into the slots of the table and back into the machine tank. The holes were spaced at intervals around the fixture. This scheme has been found to work very satisfactorily, since such chips as are carried down into the recess have not marred the bearing surfaces or interfered with the operation in any way.

The end of the fixture which has the adjustable stops

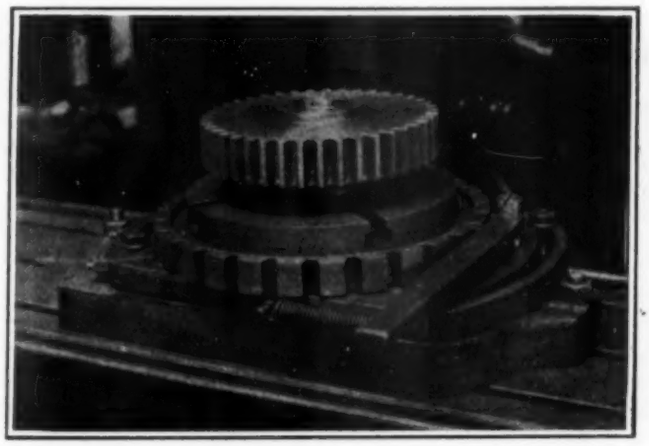


Fig. 3—Clutch-milling fixture—Right front

IDEAS FROM PRACTICAL MEN

for turning the work through the angle required to bring the cut radial, is shown in Fig. 2. Stop *M* is fixed at zero, while stop *N* is adjustable and may be set to the graduations on the end of part *I*. After the stops have been set, it is a simple matter for the operator to shift the fixture from one stop to the other. Bolts as at *O* are provided for clamping the two lower members together.

The indexing ring *L* is removable to permit its replacement with one having a different number of notches. For convenience in operating, each indexing ring has the spaces marked to correspond with the combinations of clutch teeth that can be cut with it.

Part *H* is the part with which all the indexing is done and to which all the work is clamped and T-slots have been provided for clamps to hold work with excessive height.

In Fig. 3 is shown the end of the fixture from which the indexing is done.

The operation of the fixture is as follows: First the proper arbor is fastened into place, the split bushing dropped over it and then the work is put in position. The bolt is then brought down to expand the bushing. One cut is now taken around the work in the usual manner. To index, the operator pulls the lever out of the notch and moves the work and the faceplate around to the next proper space in the index ring and lets the lever snap back into place. After the first cut has been completed and the stops *M* and *N*, Fig. 2, set in position, the bolts in the central member are unclamped and the upper part of the fixture is swiveled through the predetermined angle. The fixture and milling-machine table are now moved an amount equal to the thickness of the cutter. This movement is accomplished by the cross-feed screw of the machine. After the bolts have again been clamped, the work is ready for the second cut. It is obvious that the second piece is started from the position where the first left off, bringing the fixture back into the starting position upon its completion.

It should be noted that the over-all height of the fixture has been kept extremely low, being 5½ in. Bearing surfaces are relieved to reduce friction and permit the parts to revolve freely. The entire design is simple and rigid and in actual operation has proved efficient. It has been possible to reduce the time allowance for milling clutch teeth with this fixture from 50 to 60 per cent with a gain in the quality of the work.

The range covered is from ⅞- to 4-in. diameter bore and ⅞ to 6 in. in height. There are six arbors and bushings to cover forty-seven variations in bore and five indexing rings which give nineteen combinations of clutch teeth.

Two Printing-Press Shop Fixtures

By Henry F. Crawford

Every trade seems to have some peculiarities of its own as to fixtures and methods designed especially for its own class of work. A good example of this is seen in the accompanying illustrations which show the method of handling ink-fountain rolls in printing-press shops. These rolls are made from heavy pipe with trunnions inserted in the ends.

The pipe is first rough turned in a lathe as shown in Fig. 1, a muff or cup center being used to support the back end. The pipe goes into this muff and is held

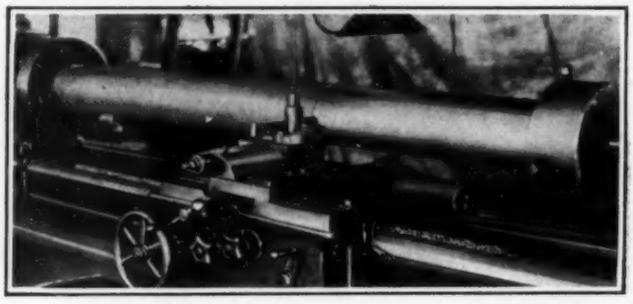


Fig. 1—Rough turning ink-fountain rolls

by four setscrews. A deep center in the flat surface affords a good support on the tail center.

The ends of the pipe are then bored and trunnions forced into each end. These trunnions run in special

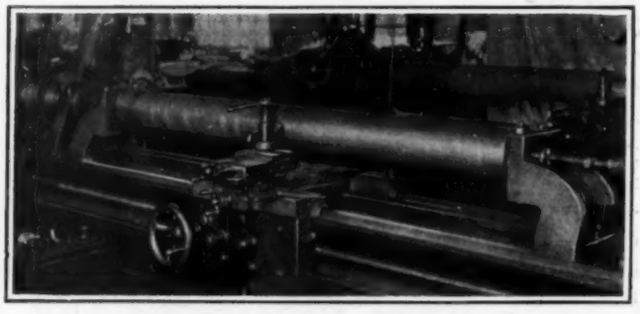


Fig. 2—Finishing on trunnions

bearings mounted on the lathe bed, as in Fig. 2. The roll is driven by a lathe dog at the headstock end and is kept in position lengthwise by the floating center *A*, which goes between the end of the trunnion and the lathe center. The roll is then finished in its own bearing.

A Pulley With an Expanding Hub

By M. A. Schmidt

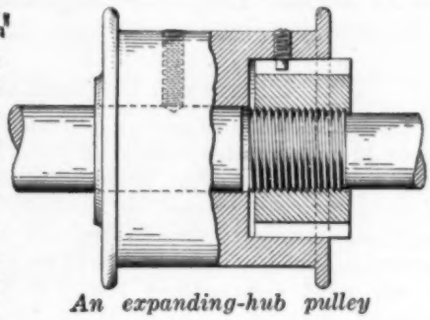
Herewith is a sketch of an "expanding-hub" pulley for grinding stands. We have been using pulleys of this kind for a number of years and they have eliminated the very troublesome end play in our grinders.

Probably no machines around the shop get as much abuse as general purpose grinders. They used to be made with the familiar *V* grooved bearings, but after a short time that meant a lot of scraping to keep them in order. Collars, too, have been tried. But collars work loose. The pulley shown is easily adjusted and the adjustment stays put.

The pulley is counterbored about 1½ in. at one end and is fastened to the shaft with a setscrew, the point of which enters a hole in the shaft. The shaft, or arbor, is threaded where the recessed part of the pulley covers it, and into the recess an internally threaded collar is placed. The collar is screwed on to the shaft and should project about ¼ in. beyond the face of the pulley. The periphery of the collar has a number of

IDEAS FROM PRACTICAL MEN

square slots—ours have twelve. A ¼-in. safety setscrew goes through the shell of the pulley and enters one of the slots in the collar. The pitch of the thread on the arbor and the number of flutes in the collar can be so proportioned that any nicety of expansion can be obtained. The hub of the pulley rides against one bearing and the expanding collar against the other.



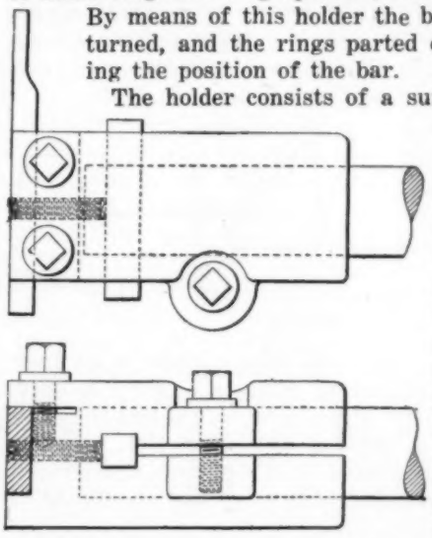
An expanding-hub pulley

There is no reason why the inside of the pulley could not be threaded and the collar have the threads on its periphery. The result would be the same and it might be cheaper to make it that way. Conditions would dictate which method should be used.

Handy Toolholder for Large Lathes

By F. E. Ervin

For use upon large lathes wherein the tools are held by stud-bolts and clamps, and are heavy and not so easily changed as when held in the ordinary toolpost of smaller lathes, the toolholder shown in the accompanying sketch will be found of great advantage. It is especially useful to hold parting and other tools used to make rings for large pistons, and for similar work. By means of this holder the blank can be bored, turned, and the rings parted off without changing the position of the bar.



Handy toolholder for large lathes

The holder consists of a suitable block, bored part way through to slip over the end of the boring bar. The side toward the operator is split up as far as the square hole that accommodates an ordinary square tool bit, and is provided with a clamping screw to bind it on the bar. The square hole is so located that the toolbit passes through the hole in the end of the bar and thus prevents the holder from turning.

On the outward end of the holder is a slot equal in width to the larger dimension of the tool shank and equal in depth to the thickness of the shank. From this slot the holder is slit back for an inch or two and provided with a couple of collar-head binding screws located as closely to the bar as possible and screwed into the lower part of the holder.

When a large boring bar, 3 in. or more in diameter, is used, it is quite a job to take it out and insert a tool for parting off a ring, and when the pot casting is so large that it will not swing over the lathe carriage it is most awkward to reach the right place with a parting tool.

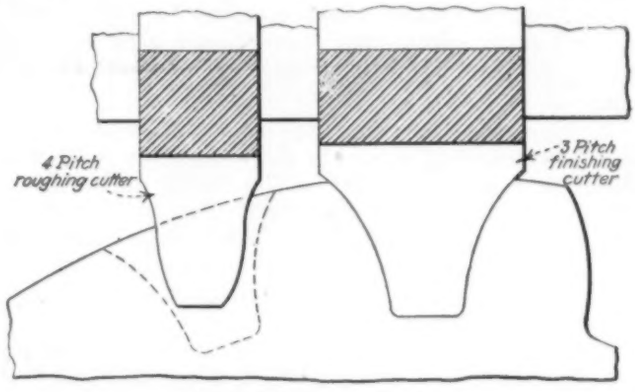
With this device, it is the work of but a minute to change from boring or turning tool to a parting or facing tool and back again. Straight-shanked parting tools can be used to advantage and rings can be parted off close to the jaws of the chuck.

Roughing and Finishing Gears at One Pass

By Donald A. Hampson

The practice of roughing out gears previous to the finishing cut is well established. The reasons for it are to lessen the stresses upon the machine, to produce better teeth and to save the finishing cutter.

At the plant of the Bradney Machine Co. in Middletown, N. Y., 3-pitch cast-iron spur gears are cut on a Gould & Eberhardt machine. The press of work made



Two cutters on one arbor

it necessary to run the gear cutter day and night, and to relieve this condition it was concluded that a faster feed was the most logical method, provided it could be accomplished without sacrificing accuracy and without lessening the time between grinds.

The method adopted was to put a roughing cutter on the arbor with the gear cutter. This cutter was not a plain milling cutter nor a stock roughing cutter, it was a 4-pitch gear cutter. Properly spaced, it roughed about all that was possible to take out and be sure of leaving stock for finishing, and it produced an outline that left a well balanced cut for the finishing cutter.

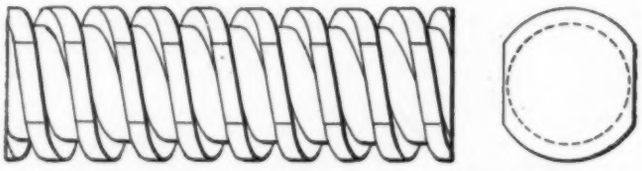
The department, "Ideas from Practical Men," is devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for.

PRACTICAL SHOP PROBLEMS

Questions of a Practical Nature will be answered in these columns

Threading Special Stock

Q. We want to cut some threads on bars of cold-rolled steel as per sketch enclosed. The threads are to be triple, ½ in. pitch and 0.499 in. in diameter. The bars are 10 ft. long and are flattened on two sides. The screws are to be of the size mentioned within 0.001 in., plus or minus. The production required will be about 120 bars per sweek. Will you tell us what method you consider the best for doing this work?



A. The bars can be threaded in either a thread milling machine or in an automatic lathe. The cheapest method would be to thread them in a bolt cutter, but we doubt whether they would be accurate enough for your purpose, either in diameter or pitch.

In any case the rods will have to be straightened after the threads have been cut, as cold-rolled steel is notorious for springing after the skin has been cut.

Babbitting Rod Bearings

Q. Can you tell me the most modern method of applying "tinned in" babbitt bushings to the lower ends of connecting rods? We have always used die-cast bushings and therefore have no data on the "cast in" process.

A. There are several methods of babbitting the lower ends of connecting rods. In most cases the holes are tinned to make the babbitt adhere tightly to the steel. The rod ends must be thoroughly cleaned, dipped in an acid solution, rinsed in water and then immersed in molten tin. They are then placed in a fixture having a steel pin to act as a core and the babbitt is either poured or forced in between the rod and the pin.

In the Ford plant, the rods and caps are treated as separate units and are placed in closed molds. The babbitt is forced into the molds under pressure, the same as in die-casting.

Another method is to make what are known as centrifugally-cast bearings. The rods and caps are bolted together and tinned. They are then mounted on the faceplate of a vertical-spindle machine, the center of the large end being in the center of the faceplate. Pads of sheet asbestos, or other heat-resisting material, are placed above and below the rods. The outer pad has a hole in the center and is held on the rod by a clamp.

With the faceplate revolving, the babbitt is poured through the hole in the upper pad. In this method the babbitt is thrown against the surfaces of the hole by centrifugal force, making a dense lining, free from air bubbles. The ladle from which the babbitt is poured, holds just enough metal for one bearing.

In all processes of tinning and babbitting, the rod ends must be chemically clean and must not be touched by the hands between operations. For a detailed description of methods of cleaning, see "The Hispano-Suiza Airplane Engine" on page 855, Vol. 51, of the *American Machinist.*

A Problem in Normalizing

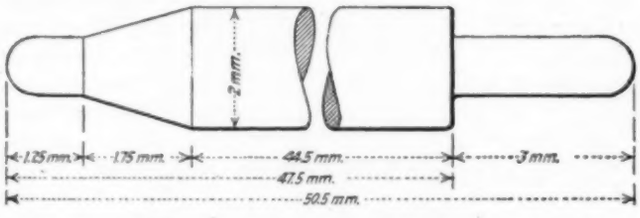
Q. We have in use a large quantity of stud bolts from ¾ to 1⅝ in. diameter and made from Jones & Laughlin cold-rolled steel. The studs are under pressures of from 250 to 500 lb. and are subject to varying degrees of heat. Owing to time in use they have changed their original formation and are more or less crystallized.

At what temperature could they be normalized? Should they be cooled in the air or in lime? What temperature should be used in heating them so as to harden them in quenching oil, to bring the metal to the same state as when received from the maker? What is the carbon content of the metal?

A. The best answers to the questions asked, can be obtained from the maker of the steel, the Jones & Laughlin Steel Co., Pittsburgh, Pa. All we can say is that cold-rolled steel is not hardened, other than the surface hardening incident to the process of manufacture, and it would appear to us that the studs could be normalized by heating to about 1,300 deg. and allowing them to cool in the furnace.

Work for the Automatic

Q. We have a large quantity of shafts to make as per the sketch herewith. They are to be made of silver-steel wire 2 mm. in diameter, so that the only machining will be at the ends. Would an automatic screw machine be suitable for the work?



A. The shafts can be made to advantage in an automatic screw machine having either a single spindle or multiple spindles. One end can be turned and the shaft cut to length. For turning the other end, a second operation will be required. For the second operation, the shafts can be chucked either by hand or automatically from a magazine.

Fusing Cast Iron to Steel

Q. Can you tell me how the steel faces are welded to the jaws of machinists' vises.

A. The steel faces of vise jaws are not welded to the jaws but are fused to them in the process of casting. The steel faces are tinned on the surfaces that are to be fused to the jaws and set in the mold in a depression made by a print on the pattern. Pouring the iron fuses the tin coating and causes the steel faces to adhere.

Technical Abstracts

Control for a Thirty Day Turn Over

R. J. Reiser, factory manager, H. D. Wallace & Co., makes wood working machines and utilizes the experience of the automobile industry in arranging for the control of his production. By carefully eliminating every effort that does not contribute directly to production he has increased the output of the machine shop by 50 per cent; has cut the working force by 25 per cent and the amount of supervision has been reduced 30 per cent. This has been accomplished by systemization alone, and no additional equipment has been purchased for the carrying out of this plan. Automobile methods were not copied exclusively, but some of the advantages of progressive assembly were gained by applying some of its principles.

Considerable time was originally lost through back-tracking as the various parts passed from one machinist to another and considerable delay was caused by different groups of parts getting in the way of each other. Further, not all machines were doing identical jobs in the same way and errors in judgment accounted for a great deal of waste effort and time. Another source of delay was the time spent by employees in asking the foreman for new work. No individual spent any considerable time in this manner, but when all such time was totaled the gross loss was surprising. There was also considerable time wasted when the worker went to the stock room to get material and idle machines were found to be as bad as idle men. It was not realized formerly that every time a machinist went to ask for work or get stock his machine laid off too. The solution of these troubles was found by proper control, and by the determination that from the time the raw material was received in the shop to the time it went out the shipping room door as finished machinery, each step and operation should be performed according to methods carefully worked out and specified. As little as possible was left to the judgment of the worker and he was not allowed to make any move that did not bear directly on production. A rearrangement of the machines eliminated most of the back tracking and reduced the floor space held by the production department more than 10 per cent. The present routing is in general, circular. From the receiving room, materials move directly to the stock-room, then to the machinery room, then to the assembly department, then to inspection and finally the finished machines are within a few feet of the receiving and shipping door at which the raw materials started.

By following the control as described, J. D. Wallace & Co. gets about twelve turns a year on its investment in materials. The basis of this control is a schedule in which the machining of parts is completed 25 days ahead of the shipment of finished machines and purchases are scheduled to keep exactly 30 days ahead of shipment.—*Factory*, December, p. 786.

Power Problems

The cost of power in American industries is equal to one fourth of the total wages paid. This statement has been proved by various companies. The cotton goods industry uses four horsepower for every man employed; the lumber products industries use five horsepower to each man; the chemical industries employ eleven horsepower to each operative; in cement plants this is boosted to eighteen, while in iron and steel blast furnaces there is a ratio of forty-two horsepower for each employee. The annual payroll of American industry exceeds ten billion dollars and a curious thing is that labor costs are analyzed and cross analyzed in minute detail, yet power costs are practically accepted as they stand. This article goes on to state that the cost of power in the average industrial plant is just twice what it should be and that more than a billion dollars in profit is wasted each year. It is stated that an average factory of 500 employees wastes $45,000 per annum in inefficient power plant operation. —*Industry Illustrated*, December.

Hardness Testing

The editorial deals with the fact that, although the Brinell ball test is so widely used, investigators and research workers still devote a large amount of time and ingenuity to its further improvement, and to the devising of alternative methods of measuring hardness. This indicates that the test does not meet all the needs of the engineer. In America, the Rockwell hardness tester, and in England, the Herbert pendulum tester, have been developed as improvements or to get other characteristics. The Herbert tester, for example, claims to measure the work hardening properties of the material which has heretofore only received vague general consideration, but should be studied in detail.

The Rockwell cone indentation measures something which while of the general nature of "hardness," is not the same property as that tested by the Brinell ball. The true nature of this difference is well worthy of closer study.

Dr. Hultgren of Sweden has produced a super-hardened type of ball for making indentation tests on very hard materials and has thereby undoubtedly succeeded in extending the applicability of the test to steels of higher hardness. The more interesting aspect of Dr. Hultgren's work, however, is the fact that he has succeeded in super-hardening full hardened steel by a process of cold working. The fact that subjecting fully hardened steel balls to running under severe loading leads to further hardening, is of considerable importance and will be, to many, sufficiently surprising. It suggests that in the hardness of so-called "glass hard" steel the fullest capabilities have not yet been developed.

The immediate practical results of these advances in the testing of hardness are not, perhaps, of a very striking character, but in these days of intensive scientific research and of rapid development of new processes and new products it is necessary to pay careful attention to the beginnings of such new developments.—*The Engineer* (England), Oct. 17, p. 439.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

The Air Mail Helps a Machine User

THAT the air mail from coast to coast is not an expensive frill but is playing a real part in the mechanical and other industries, is shown by a recent incident.

A machine shop in San Francisco broke a small but essential part of a Blanchard grinder. The manager immediately wired the makers in Cambridge, Mass., for a replacement part. With equal promptness the Blanchard Co. started the piece westward by air mail.

In spite of winter weather, of storms over the two great mountain ranges, the air mail pilots delivered the part in San Francisco so that the machine was ready for service in thirty-six hours after the wire was sent. It was not so long ago that it would have taken as many days to get the repair part to a machine 3,000 miles away.

Such prompt shipment reflects credit on the machine builder and the rapid delivery of the part shows that the cross-continent air mail is performing a real service. Such instances prove, if proof be needed, that we can consider the air mail as a part of every-day business and use it regularly for letters and parcels where time is at all important. For this was not a special or stunt performance, but a part of the regular work that is going on for our benefit.

A Conference on Distribution Problems

A DISTRIBUTION Conference to be held next week at Washington in the beautiful new home of the Chamber of Commerce of the United States is an indicator of what business men are thinking about. Demagogic howls against the iniquitous and superfluous middleman have stirred up some public clamor but have had little effect. An occasional economic study of the relative costs of production and distribution has been given closer attention in business circles but as yet nothing very definite in the way of remedial suggestions has crystallized.

If the Chamber of Commerce gathering is as successful in boiling the many opinions and more or less distantly related facts down to fundamental principles, as the Transportation Conferences have been in that field, the public will be deeply indebted to those responsible.

In the machinery industry there is a growing understanding of the fact that savings in manufacturing costs can usually be of only an insignificant nature as compared to those possible in distribution costs. The production men have been plugging away for years and have done wonders in reducing the costs for which they are responsible. It is high time for those on whom rests the responsibility for economical distribution to see what they can do along the same lines.

In all probability careful investigation will prove that machinery, usually a capital investment charge, is distributed far more economically than is the general run of consumption goods. If this turns out to be the case, the position of the machinery manufacturers and dealers will be correspondingly strengthened.

Two and Two Still Make Four

RELATIVELY few shops have machine tools which cost more than a few thousand dollars. Single machines costing $5,000 or more are the exception rather than the rule. Figuring on 10 per cent for depreciation and 5 per cent for interest, such a $5,000 machine would cost annually $750.

On the other hand, any shop has a number of men who cost the company annually $1,500 or more. If one of these men can be eliminated by the purchase of a machine, an annual saving can be made of not less than $1,500. This saving, capitalized at 15 per cent, indicates that a machine costing $10,000 more than the two machines, used by two men, can be purchased.

Looking around various shops, one wonders if this line of reasoning is followed. If so, why is there still such a predominance of old and unproductive machinery?

Just Suppose

JUST suppose somebody should tell you that power looms are all right for plain goods but that hand looms are the only practical machines to use for figured goods; because, he says, there is such an endless variety of patterns that machines would have to be changed over at short intervals. If he told us that, we would just take him to almost any textile shop and show him row upon row of Jacquards and point out that not a single hand machine is in sight.

Now suppose somebody told us that it is not practical to use automatic machine tools, except in a few cases, because there is such a great variety of jobs that machines would have to be changed over at short intervals. Why, we would just take him. . . . Yes, just where would we take him?

But, you say, it is foolish to compare a machine tool to a loom.

Maybe so, but all the same

Just suppose.

Shop Equipment News

Micro Internal Grinder

A heavy-duty internal grinder, particularly adaptable for railroad shop use, has been placed on the market by the Micro Machine Co., Bettendorf, Iowa. The machine illustrated is known as Model D.G.

The machine may be used for either dry or wet grinding, the supply of coolant being controlled by a lever located on the front of the machine. A belt-operated pump on the outside of the base, at the rear, forces the coolant through the hollow spindle against a baffle plate, which throws it centrifugally against the path of the wheel to keep it free of chips.

A pantograph type of drive keeps the spindle speed constant, and is planned to eliminate all belt back lash. In order to secure what might be called the proper work speed for holes of different sizes, arrangement is made to vary the orbital travel of the grinding wheel spindle. In order to facilitate centering of the work, the main bearing can be revolved by means of a handwheel, shown on the side of the headstock.

The spindle is mounted in ball bearings, all oil holes being protected by filters to exclude grit or dirt from the bearings. Special seals have been designed to retain the lubricant. Bronze bearings with automatic lubrication are provided for the main cylinder, other bearings in the machine being either of the ball or roller type.

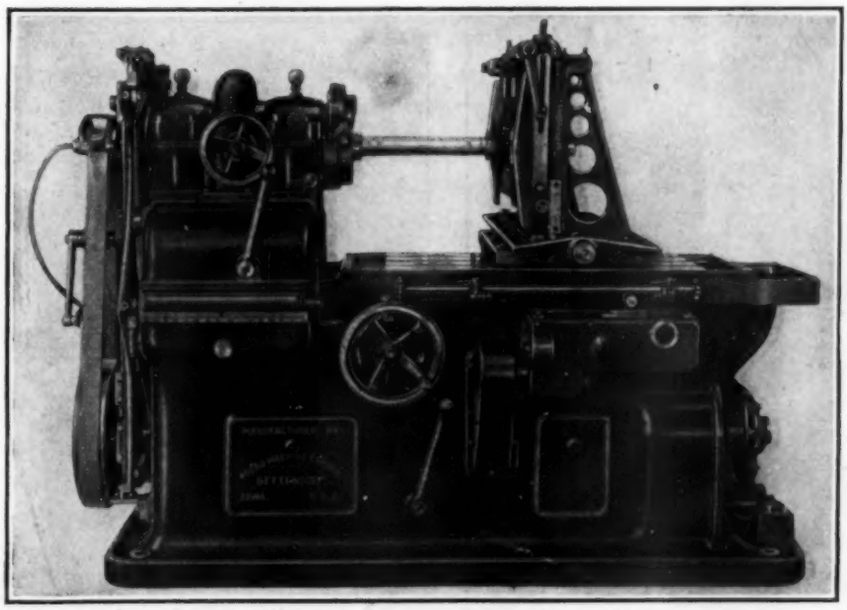
A 3-hp. motor located in the base drives the moving parts through a standard friction clutch. The clutch operating lever is at the front of the headstock.

The bedways are 4 in. wide by 52 in. long, and are cast integrally with the base. They are lubricated by four oil wells provided with rollers, the wells being connected to equalize the oil film. The table is 20 in. wide by 48 in. long, and has a center rack drive. Automatic stops are provided, as are waterways for use in wet grinding. Three longitudinal T-slots provide for the mounting of irregular work. The universal work-holding fixture is mounted on a cross slide sub-plate, with a total cross travel of 29 in. Work may be mounted on either side of the parallel bars, which are joined by a connecting link so that they can be adjusted individually or as a unit. Five speeds are provided for the table.

The reverse gear box is an inclosed unit with automatic forced feed lubrication. Elsewhere on the machine, alemite lubrication fittings are provided.

The standard grinding range includes holes from 2½ in. in diameter up to 10 in. in diameter and 19 in. deep. With special sprindles, however, holes may be ground from 1 in. to 15 in. in diameter and in depth up to more than 19 in. As the distance from the center line of the spindle to the top of the table is 14 in., holes larger than 15 in. in diameter may be ground, providing the mounting of the work will permit.

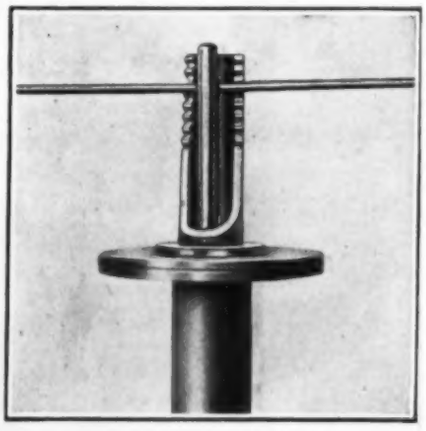
Floor space required is 4 ft. 6 in. by 9 ft. The base is 84 in. by 29 in., and the overall height 63 in. The machine weighs approximately 6000 pounds.



Micro Internal Grinder

G. E. Electrode Holder for Metallic Arc-Welding

The General Electric Co., Schenectady, N. Y., is marketing a simple type of welding-electrode holder, allowing welding operators to quickly replace burnt stubs by new electrodes.



G. E. Electrode Holder

The accompanying illustration shows a ⅛-in. electrode in the jaws of the holder, the front-part of which is removed to reveal the inner structure.

The holder consists of a punched

SHOP EQUIPMENT NEWS

fiber tube with a tinned brass plug inserted in the end. A steel spring rod holds the electrode in place against one of a number of different-sized notches provided for the purpose. The welding cable, running to the source of power, is soldered to the other end of the holder by removing the fiber tube and the fiber guard, which is accomplished by loosening a single screw.

When necessity arises, the operator needs only to strike the stub end of the old electrode, causing it to drop out, and the new wire can be inserted.

Gisholt Arc-Grinding Attachment to Internal Grinder

The Gisholt Machine Co., Madison, Wis., has equipped its internal grinder with an arc-grinding attachment, illustrated in Figs. 1 and 2, which is particularly adapted for grinding links and link blocks and in general for radius-grinding work.

The attachment, as shown in Fig. 2, is mounted on the work table *A* and consists of a cross-slide *B* in the center of which is located a pivot *C* carrying a cradle *D* free to rock on the pivot.

A rail *E*, pivoted in *F*, in the same horizontal plane as the pivot *C* for the cradle, and having an angular adjustment in the vertical plane, through rail-clamp *G* and rail-adjusting screw *H*, controls the rocking motion of the cradle as the cross slide travels back and forth

The grinding-wheel spindle *I*, located in the same vertical plane as the rail pivot, remains stationary so that the combination movement of the cross-slide and the cradle will produce a circular arc *J* tangent to the grinding wheel. The center of this arc is located on a line normal to the cradle and passing through the center of its pivot. The angular adjustment of the rail for the desired radius is obtained from a chart mounted on the attachment.

The cross-slide is driven by power from the regular table-feed screw, which is provided with a clutch for disconnecting the power feed of the work table. The power movement of the work table and cross-slide, therefore, cannot take place simultaneously, but the hand feed is always available for the work table, so that it occasionally can be moved back and forth to insure even wear of the wheel and a parallel surface.

The feed-trip and reverse lever controls the reverse motion of the

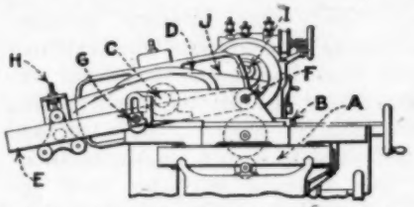


Fig. 2—Left-Side view of grinder with attachment

cross-slide table through the regular table-trip mechanism which also can be operated by adjustable trip-dogs on the trip-disk when automatic reverse is required.

The arc-grinding attachment weighs approximately 500 lb.; the total weight of the machine is 3,100 lb. A 5-hp. motor, running at 1,800 r.p.m., is recommended to drive it.

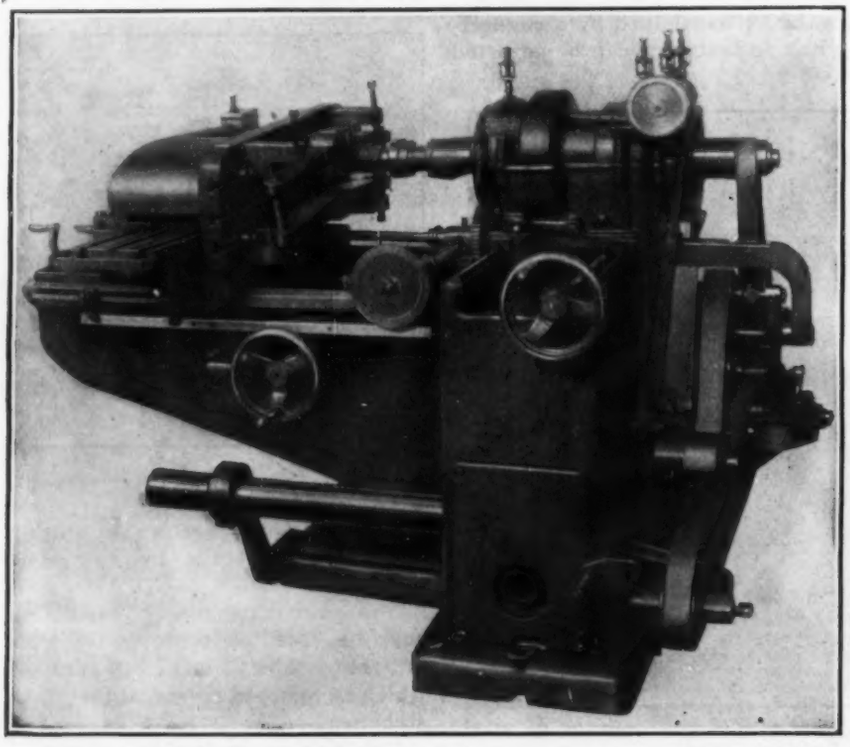


Fig. 1—Gisholt Arc-Grinding Attachment to Internal Grinder

Clark Grinders and Buffers

The Jas. Clark, Jr., Electric Co., 520 W. Main St., Louisville, Ky., has recently added to its line of electrically driven tools a floor-type grinder and a bench-type buffer and grinder.

The floor-type machine, shown in Fig. 1, has a 5-hp. enclosed motor, wound for direct or alternating cur-

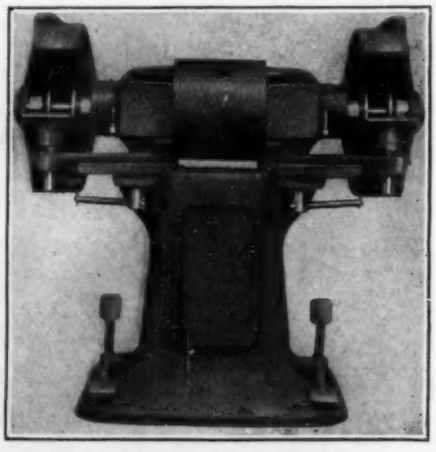


Fig. 1—Clark Floor-Type 5-Hp. Grinder

rent of the desired voltage and phase. A duplex pedal control is provided in order that the operator may keep both hands on the work. The alloy-steel spindle runs in ball bearings.

SHOP EQUIPMENT NEWS

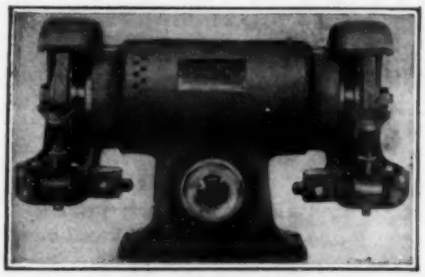


Fig. 2—Clark Bench-Type Grinder No. O. U. 5

The starting device and fuses or relays are enclosed in the base and are exposed by opening the hinged door.

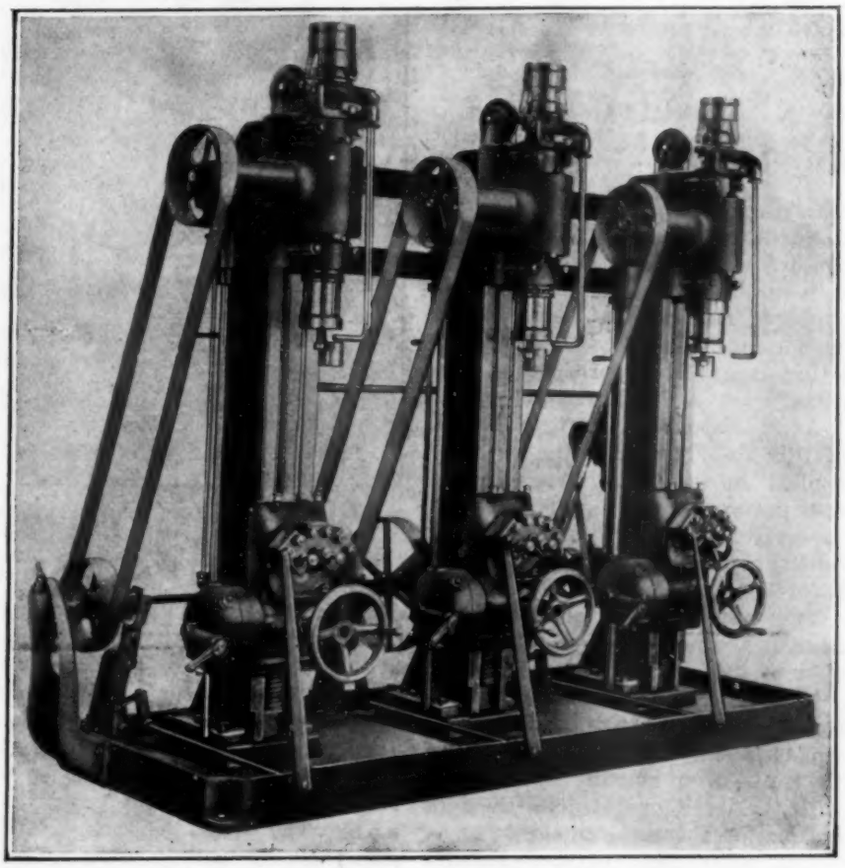
When supplied for buffing the spindle is extended. The height to the center of the spindle is 34 in. The distance between the centers of wheels is 36 in. for the grinder and 58 in. for the buffer. The diameter of the grinding wheels is 16 in. and the width 3 in. They run at approximately 1,150 r.p.m. The weight of the machine is 1,200 pounds.

The bench-type machine, shown in Fig. 2, known as the No. O. U. 5, has a ¼-hp. enclosed motor for direct or alternating current. It is intended for very light grinding of small pieces and small tools or for light polishing and buffing. The machine is provided with removable tool rests. The spindle runs in ball bearings. The equipment comprises a taper-threaded extension, one wire wheel and one buffing wheel.

The height to the center of the spindle is 6 in., and the distance between the centers of the wheels is 11½ in. The wheels have a 5-in. diameter and ½-in. width. They run at approximately 4,200 r.p.m. The weight of the machine is approximately 44 pounds.

Stecher Deep Hole Drilling Machine

A machine designed for drilling deep holes in spindles, hollow shafts and similar work, and known as a deep hole drilling machine, has been placed on the market by the Charles Stecher Co., Inc., 2452 Greenview Ave., Chicago, Ill. The machine is vertical in construction and the machine shown in the illustration is so designed that the spindles are located on a common base. It can be furnished in single units, however, if desired.



Stecher Deep Hole Drilling Machine

The work is held in the spindle of the machine, into which it is inserted from the bottom and where it is held in position by a collet chuck that is operated by means of the handle shown in the illustration. The drill is located in a turret that is attached to the column of the machine and is guided by a hardened steel hand bushing. A depth of 24 in. can be drilled without moving the head, but any length desired can be drilled by moving the head after each 24-in. depth is drilled. The machine columns can be built to accommodate any special job, accordingly. The location of the head is controlled by a worm gear and friction clutch at the left of the spindle.

The work-spindle is mounted in ball-bearings and all shafts run in ball bearings. Belt or motor drive can be supplied as desired. The floor space required is 4 x 11 ft. and the height of the machine, as shown, is 9 ft. The weight is 8,500 pounds.

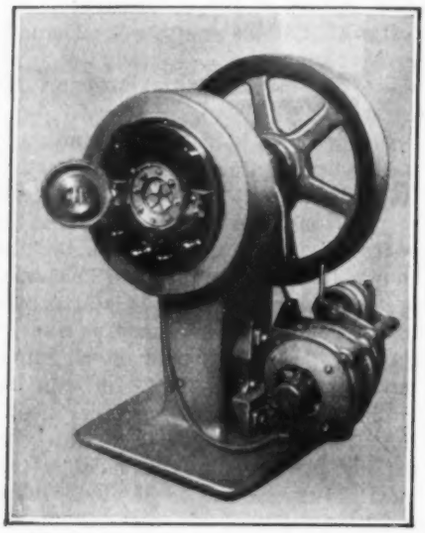
The Dayton-Torrington Four-Die Swaging Machine

The Torrington Co. of Torrington, Conn., maker of the Dayton swaging machine, has adapted the larger sizes of this machine to carry four instead of two dies. The change is brought about without material alteration of the standard type of machine by substituting for the regular spindle a spindle having four hardened-steel-lined radial channels for the dies and making minor changes in the disposition of the rollers in the roll-rack whenever the latter is necessary.

It is essential that the number of rollers be divisible by four for the reason that the successful operation of the machine depends upon having both pairs of dies strike the work simultaneously, and it is because of this fact that some of the roll-racks must be changed to correspond to the new spindles.

The principal advantage claimed for the four-die machine is that it produces work more rapidly, permits a greater range of reduction at each

SHOP EQUIPMENT NEWS



The Dayton-Torrington Four-Die Swaging Machine

pass and eliminates one or more of the annealings to which the work must be subjected when the total amount of reduction demands several successive operations.

Because of the necessity for beveling the ends of the dies in order to bring them to bear upon the work the use of the four-die machine is limited to sizes of ¼ in. and larger at the finish, and the increased rate of production is gained at the sacrifice of extremely accurate diameters and the smoothness of surface of which the standard machine is capable. To obtain these, the maker recommends the two-die machine, but upon the ordinary run of work the greater output capacity becomes the more important consideration.

The machine is driven by belt from an overhead line, or from a motor mounted upon the base. Motors for any commercial current can be supplied. The machine is here shown with the retaining gate swung open to show the dies.

The four-die spindle is applicable to the Nos. 3, 3½, and 4 machines, and the amounts of the reductions obtainable by these machines are from ⅜ in. to ¼ in., from ⅝ in. to ¼ in., and from 1½ in. to ¼ in., respectively. These sizes are for solid material. Tubing of approximately double these diameters can be reduced.

The weights of these three machines are 925 lb., 1,750 lb., and 2,450 lb. and the floor spaces required are 26x27 in., 26x30 in. and 30x35 in., respectively.

Fox No. 24 "Superflex" Twelve-Ton Straightening Press

The Fox Machine Co., Jackson, Mich., has recently put on the market a straightening press of a maximum capacity of twelve tons, known as the No. 24 "Superflex."

The illustration shows the press with the holding fixture for finish-straightening axles for six-cylinder engines. A pressure gage, located on the ram and a pressure-regulating stop are also shown. The anvils, which are inserted at different points under the axle to take the pressure of the ram, are not shown.

In the finish-straightening of an article such as a crank shaft, it is necessary to have it supported on a fixture that can be easily moved longitudinally under the ram of the press. At the same time the holding fixture must be yielding in its bearings so that when the pressure of the ram is brought to bear on the axle it will have a solid support on the bed of the press. These requirements have been taken into consideration and the corresponding features embodied into the design of the fixture. The wheels on which it rolls are all mounted on yielding supports as well as the bearings supporting the axle, in which the latter is revolved for testing purposes.

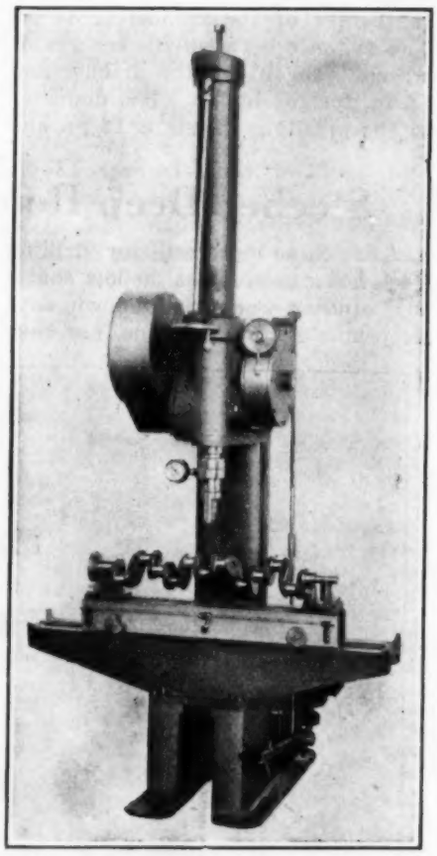
As it is also important, in a work of this character, that the pressure applied in the straightening press does not exceed the required amount to correct the deflection, two precautionary measures are taken, as follows:

The first is to have the pressure gage on the nose of the ram in plain view of the operator.

The second is a pressure regulator consisting of an adjusting screw, which passes through the front of the brake-drum housing and contacts with the lever, operated by the foot treadle, on the opposite side.

The adjustment of the pressure regulating screw determines the amount of pressure which can be brought upon the brake band, and this in turn determines the pressure which the ram will apply to the work.

To illustrate this on the twelve-ton press, let us suppose that the straightening pressure required is only two tons. The handwheel shown on the brake-drum housing is turned until the dial indicates two tons at the pointer. When the treadle is depressed, this pressure is delivered at the ram. Should the operator put his whole weight on the treadle, it is claimed that no greater ram pressure than these two tons required would be obtained, although the maximum capacity of the press is of twelve tons.



Fox No. 24 "Superflex" Straightening Press

The maximum length of the axles to be straightened is 37 in., and their maximum swing—10 in. The stroke of the ram is 18 in. The motor attached is of 10 hp. and makes 1,200 r.p.m. The press, together with the straightening fixture, weighs 3,000 pounds.

News of the Week

Hoover Forecasts Year of Prosperity in the United States

Entire world gaining with further strides in 1925 predicted

Secretary Hoover, in response to many requests for a statement upon the economic prospects of the new year, has issued a statement, excerpts of which are as follows:

"A forecast of the business future must be simply a weighting of the economic and political forces in motion. The annual survey of the Department of Commerce shows that the New Year begins with the economic structure of the world upon more solid foundations than at any time since the war. With the exception of a few spots of secondary importance there has been during the past year a real advance toward social, economic, and political stability throughout the world. Generally the world is producing more goods, there is fuller employment, there are higher standards of living, more assurance of economic stability for the future and more promise of peace than we have seen for many years.

"The average wage in industry has been stable during the last year, and remains around 100 per cent above pre-war, while the cost of living has maintained almost exactly the same level at the end of each of the last three years, 1922, 1923 and 1924, about 72 per cent over pre-war. Our labor, therefore, continues to enjoy the highest real wage in its history. There was some unemployment in the middle of the year, but it has now been largely overcome.

The Year's Progress

"While there was some slackening of manufacturing production as a whole in the spring due in part to the uncertainties of election and in part to reduction of accumulated stocks, yet there was but little slackening at any time in consumption of major articles as shown by the continued high levels of car loadings, of sales of wholesale and retail establishments and of construction activities. The end of the year finds us with a recovered industrial production at practically the same levels as a year ago.

"Our railroads have shown continued increase in efficiency during the year, and have now proved themselves equal to any burden that is likely to be thrown upon them. Motor transportation continues to develop and to enter more and more into the vital economic life of the country—in fact, almost imperceptibly our road improvement programs are taking on the complexion of new transportation systems.

"Our foreign trade has shown considerable expansion during the year in exports, and some decrease in imports. The increase in export figures has been due in some degree to the higher prices of agricultural produce, though chiefly to general expansion in all exports; the decrease in imports has been due in large part to lessening activity in production lines at the middle of the year, thus reducing the requirements for imports of raw material. The total of our exports for the year will show about four billion six hundred millions and our imports about three billion six hundred millions. The merchandise balance will be about one billion dollars in our favor. The net gold imports for the year in partial liquidation of this balance amounts to about two hundred and eighty millions.

Inflation Warning

"It has been suggested in some quarters at home and abroad that the result of these favorable factors may be leading our country toward a period of inflation of the character of 1919-20 with its disaster of 1921. It can be assuredly stated that we are on the march of wholesome recovery from the war and there is no present indication of inflation. We only secure inflation when undue expansion of credit finds its outlet in bidding up prices after the plant and labor capacity of the country is employed to the maximum. We have reached no such stage because there is still a margin of labor capacity for enlarged output in the form, however, of more full-time employment than from people out of work. As a nation our business men, bankers and public officials have gained enormously during the past four years in understanding of the basic factors that create healthy prosperity as distinguished from over expansion as well as in understanding of their responsibilities in the matter. Our informational services are now upon such a basis as quickly detect dangerous currents.

"Altogether forces in motion both at home and abroad mark solid progress toward peace and toward prosperity for the coming year."

Predicts Large Auto Sales

Automobile sales next year will approximate 3,500,000, according to C. A. Vane, general manager of the National Automobile Dealers' Association. He expects an active and prosperous year in the industry in all parts of the United States as well as an increased export business.

E. C. Peck Retires

Eugene C. Peck, works manager of the Cleveland Twist Drill Co., Cleveland, Ohio, has retired after twenty-five years af active service with this firm. During these years Mr. Peck has done much to introduce newer and better methods both in selecting and

Eugene C. Peck

treating steel and in the various operations involved in machining drills and reamers. He has long been a strong advocate of standardization. As a lieutenant-colonel in the Ordnance Department during the war, he was Chief of the Gage Section of the Engineering Division and senior Army representative on the National Screw Thread Commission, of which he is still a member. In addition, Mr. Peck is chairman of the Standardization Committee of the American Society of Mechanical Engineers as well as chairman of the Committee on Plain Limit Gages.

Cards and Calendars Received

Christmas cards and calendars were gratefully received by the *American Machinist* from the following concerns:

E. C. Atkins & Co., Indianapolis, Ind.; the Cincinnati Planer Co., Cincinnati, Ohio; the Barnes Drill Co., Rockford, Ill.; the F. X. Hooper Co., Inc., Glenarm, Md.; the Norma-Hoffman Bearings Corporation, Stamford, Conn.; the Brady Brass Co., Jersey City, N. J.; Sleeper & Hartley Inc., Worcester, Mass.; the National Acme Co., Cleveland, Ohio; the Whitman & Barnes Manufacturing Co., Akron, Ohio; Henry J. Stetler; the Norton Co., Worcester, Mass.; and William K. Stamets, Cleveland, Ohio.

Universal Adoption of Many Features Characterizes Auto Show

Trend toward standardization in construction and style seen

It is a far cry from the first automobile show in Madison Square Garden to this year's show in the 258th Field Artillery Armory, New York City. When one begins to make comparisons there is almost no stopping place. The attention to fire hazard alone shows the change in attitude in the twenty-five years that have elapsed. For at the first show a track was provided on which exhibitors could demonstrate to the curious, if not the buying public, that the vehicles would actually run. And on the roof one enterprising builder of steam cars built a very steep incline up which one of his cars was driven at frequent intervals. Only the favors of the gods prevented burning down the old Garden in those days of high test gasoline with only a few buckets of sand between the gasoline in the car tanks and destruction.

There are several significant features in the 1925 show. The very noticeable increase in closed cars and the decrease in price as compared with the open models. Several high priced cars show full sized enclosed bodies at the same price asked for open cars. Nearly every builder has followed the "coach" idea, although not always using that designation. As a result of the closed car tendencies of the past few years there seems to be little dobut that the open body will soon be a special and cost as much or more than the closed body. The increased production of closed bodies will doubtless lower their prices still more. The one piece windshield is growing in favor.

Fewer Exhibitors

There is a noticeable decrease in the number of builders over former years, indicating that the weeding out process has begun in earnest. It also shows that some of the conservatively capitalized and managed assemblers are going to be a factor in automobile production for some time. The eight-in-line motors are increasing in numbers; not all of them large in either power or size. Two former advocates of the eight cylinder V type are now putting out sizes, one with the same type of overhead cam shaft that characterized the eight. The Knight engine is now appearing in six cylinder form, although the four is still retained, in one case with the Lanchester balancer that smooths out vibration to the point of elimination. The rivalry between small fours and sixes is still keen, one large builder of small fours adding a small six to his line.

The four-wheel brake is apparently considered as a fixture by most builders, the hydraulic type of brake being seen in additional numbers. In some of the mechanical brakes, however, there has been improvement in the elimination of joints and the general simplification of the design. Balloon tires seem to have been almost universally adopted, either in the semi- or full balloon sizes, with the full balloon sizes predominating. This has brought about some changes in the steering gears, both as to gear ratio and types of gears used.

The standardization of the industry is shown by the absence of all freaks and the adoption of conservative colors for the most part. Two tone painting, in effective combinations, seems to strike the popular fancy. Body finishes of the pyroxolin base type are in favor and the general belief is that finishes of this type will supercede the old paint and varnish. Fenders continue to be baked in enamel finish and some advocates of all metal bodies are looking to this as the best finish for bodies as well. In either case the owner is to receive a more durable finish than in the past.

Although motor parts are not displayed as profusely as at some shows there is unquestionable a tendency toward greater accuracy, stiffer crankshafts, better oiling, lighter reciprocating parts and general engineering improvement. Pistons and connecting rods of aluminum alloys continue in favor in some motors and more attention to detail is noticeable in many. Air cleaning and oil purifying and cleaning devices are in evidence, both on cars and as auxiliaries. The accessories, however, do not play the part they have in some previous shows, probably because many are now being used as standard equipment on many cars.

To those who recall the cars at the first few annual shows it is amazing to see what the dollar of 1925 purchases in the way of automobiles as compared with the "good old days." A modern six-cylinder sedan, with all the comforts and many luxuries, with self-starter, electric lights, bumpers, etc., can be bought for the price asked for a single cylinder open car, without top, windshield, lamps, etc., twenty years ago. And this for a most dependable piece of mechanism, capable of railroad speeds in all kinds of weather as compared with a low powered, unreliable, uncomfortable fair weather vehicle.

And the end is not yet.

Franklin Inaugurates Uniform Service

What is announced as being the most comprehensive standardized service system ever applied to automobile repairs is now being inaugurated by Franklin dealers after a development period covering three years.

The Franklin standardized service system goes beyond what is known as the flat rate service in that the Franklin arrangement is an attempt to transplant into the most remotely located repair shop the scientific time-saving and labor-saving methods that characterize automobile manufacturing as a whole.

The official Franklin announcement of adoption of the system is preceded by this comment—"Franklin standardized service applies to automobile maintenance the same scientific control of processes which has been responsible for the economy and productiveness of American manufacturing methods."

This arrangement benefits the automobile owner, the service station and individual mechanic as well; for while the cost of labor and parts is established at a new low point, the gain to the owner does not represent a loss to the service man or station.

Facilities provided Franklin service stations for the purpose of bringing efficiency in repairs to the high point include scientific selection of tools for the mechanic's tool kit, standardized parts rack and standardized bills of material, along with service charts. The latter are individual operation layouts to guide even the inexperienced repairman in taking up the operations in proper sequence, thereby eliminating a common cause of time waste.

The operation layouts have demonstrated, according to statements of Franklin service officials, that inexperienced mechanics, also those unfamiliar with a particular job, can work with real facility and the earnings of the individual repairman are greater despite a decidedly lower cost of the total job.

Railroads Will Buy Equipment

Authority to issue equipment trust certificates to cover the purchase of $2,308,000 worth of new equipment and the expenditure of $1,281,793 for rebuilding old equipment has been asked of the Interstate Commerce Commission by the Seaboard Air Line. The carrier proposes to procure 20 Mikado type locomotives, 10 mountain type locomotives; 6 express cars; 6 passenger and baggage cars; 6 baggage and mail cars; 10 caboose cars; 1 rebuilt business car; 1,000 rebuilt box cars and 80 rebuilt caboose cars.

The Great Northern Railway Co. has applied for similar authority to issue $4,250,000 in equipment trust certificates to cover equipment as follows: 4 simple articulated freight oil burning locomotives to cost $91,000 each; 500 75-ton all-steel ore cars, $1,950 each; 900 automobile box cars, $2,300 each; 100 automobile box cars, $1,900 each; 600 box cars, $1,800 each; 500 stock cars, $1,450 each; 20 oil tank cars, $2,050 each; 25 caboose cars, $1,920; one all-steel spreader, $15,200; one 30-ton crane and ditcher, $20,000; 40 all-steel automatic air-dump cars, $3,500 each.

Union Steel Co. Buys Hartford Plant

The Union Drawn Steel Co., Beaver Falls, Pa., has purchased the Frasse Steel Works. Inc., Hartford, Conn., and will make the Hartford company the New England distributing headquarters for the products of both plants. The elimination of the "Pittsburgh Plus" cost price on steel prompted the purchase, it is stated.

Notes of Washington Activities

By Paul Wooton

Any uncertainty that may have existed as to the major policies of the American Federation of Labor has been removed by the selection of William Green to head that organization. None doubts that the new president will do his best to continue the Gompers policies. As secretary of the United Mine Workers Mr. Green always has subordinated his own personality to that of the various presidents under whom he has served. There is reason to believe that he has been the source of many of the mine workers' policies, however. In at least two important instances, when his counsel was not followed, subsequent developments proved that the union would have been better off had his advice prevailed. The selection of Mr. Green absolutely sets at rest the talk of revolutionary changes in the conduct of the American Federation of Labor.

Acrimony is a thing which Mr. Green always has avoided. He has the reputation of opposing any action prompted by vengeance or a spirit of "getting even." He always has exerted a quiet and conservative influence within the organization of the mine workers for a sane administration of the union. He stands for observance of contracts and for discipline within the union. He came originally from Ohio where the relationships between the mine owners and the men have been more amicable than in most of the mining regions.

Not Another Gompers

Those who know intimately the new president of the A. F. of L. admit that he does not have the ability nor the vision which were such outstanding characteristics of Samuel Gompers, yet they expect him to be fully as successful in the conduct of the federation because of his ability as an organizer and because he is certain not to deviate from policies that Gompers proved to be sound. Mr. Green has been brought up in a school of bargaining for immediate objectives such as higher wages, shorter hours and better working conditions. He is thought always to have been opposed to a labor party and apparently is determined to continue to work through each of the existing parties. In fact the very selection of Mr. Green is taken to indicate a repudiation of the policy forced upon Gompers in lining up with the LaFollette party during the last campaign. He has no sympathy for communism. Under his administration, it is reasonably certain that the federation will be conducted with the sole interest of supporting the interest of its membership along the lines that long have been followed.

Since Mr. Green's activities have been of a routine character he has had no opportunities to demonstrate his capacity for leadership. It is known that he possesses unquestioned courage, but whether or not his capabilities are of the outstanding sort necessary to dominate the turbulent spirits of the organized labor movement remains to be seen. Many doubt that he possesses the strategy and the skill necessary to hold his people in check.

There is reason to think that Mr. Green gave no support to the movement among mine workers looking to the nationalization of coal mines. He is thought to have realized that this proposal never has appealed particularly to the rank and file of the union. With lack of enthusiasm within the organization, he has opposed the making of an issue of a matter so calculated to offend public opinion. Regardless of what he may think of the ultimate feasibility of such a policy, it is regarded as certain that no nationalization of industry plans will be brought forward as long as Mr. Green heads the Federation of Labor.

Frank Scott New Chief of Ordnance District

Frank A. Scott, past president of the Cleveland Engineering Society, and president of the Warner & Swasey Co., Cleveland, has been appointed Chief of the Cleveland Ordnance District of the U. S. Army. He succeeds Colonel Bascom Little in this position.

Mr. Scott's duties will involve the co-ordination of industries in Cleveland and Ohio for the production of munitions for national defense in time of an emergency. The districting of the country is a part of the war department's program of industrial preparedness.

During the first eight months of the war, Mr. Scott was chairman of the General Munitions Board and the War Industries Board, at Washington, and participated in organizing the entire productive facilities of the country for war. Mr. Scott was awarded the Distinguished Service Medal for these services.

The new office carries with it the rank of Colonel, as Mr. Scott is a Colonel in the Ordnance Officers' Reserve Corps.

Charles E. Skinner Chosen Chairman of A. E. S. C.

At the annual meeting of the American Engineering Standards Committee on Dec. 11, Charles E. Skinner, a representative of the American Institute of Electrical Engineers, was elected chairman for the year 1925, and Charles Rufus Harte, representative of the American Electric Railway Association, was elected vice-chairman.

First Exhibit of the National Museum of Engineering and Industry

The first exhibit of the National Museum of Engineering and Industry held in connection with the recent Power Show, included a remarkably interesting collection of photographs of the development along many lines of industry. The material was collected at short notice through the assistance of a number of large concerns having historical data of this kind, the bulk of the work being done by H. F. J. Porter, secretary of the Museum, and Walter N. Polakov, chairman of the committee on exhibits.

The major part of the exhibit dealt with the attainments in the use of coal which is the foundation of most modern industry. The exhibit pointed out the use of coal for power purposes, but also pointed out in a striking manner the way in which the byproducts of coal enter into modern life. In addition there were exhibits of electrical development, steamships and other lines. The exhibits were well attended and attracted favorable comment as showing, even if in a very incomplete manner, the educational possibilities of the parent museum and its branches. A small portion of the display is shown herewith.

The management of the Power Show aided greatly in making this exhibit possible and successful not only providing the necessary space but also helping to secure many articles.

Portion of exhibit of the National Museum of Engineering and Industry

The Business Barometer

This week's outlet in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

SO MUCH has been written about the business "outlook" for 1925 that I am tempted to discuss the "inlook," meaning thereby our own individual experiences during the year that is past and our hopes and plans for the twelve months upon which we are now entering.

Such a discussion naturally takes the interrogatory form and the first question that suggests itself is: "How much better or worse off is each of us today than he was a year ago?" For the country as a whole the question is being answered by figures which seem to indicate that the nation has prospered amazingly. The totals of our savings bank deposits and of the life insurance in force; the value of our agricultural production and of the securities that represent our corporate wealth all show handsome gains. But the question is how much better off is each of us *personally?* By how much have *you* and *I* increased our capital and earnings and our excess of income over expenditure?

Every one will have to answer these questions for himself, but it may be pointed out that those who have not increased their capital or their excess of income over expenses are no better off than they were a year ago; that prosperity and extravagance are not synonymous terms; that the individnal is not enriched by an advance in the stock market unless he owns the stocks that have advanced, and that

"Early to bed and early to rise,
Work like hell and economize,"

remains as always the only rule by which men can permanently improve their economic condition.

The next question that suggests itself assumes that each of us seeks to better himself in a material way during the year 1925. Therefore each of us is asking himself how? Does he hope to profit by an advance in the value of what he owns or is he planning to increase his efficiency so that he can produce more or make his services worth more to his employer?

If his plans do not include increased efficiency and production it is not likely that he will find himself better off at the end of 1925 than he is today. Higher prices for one thing generally mean higher prices for most other things and a small group of acrobatic speculators are the only persons who are benefited by a rise in everything.

These homely observations are offered in lieu of a forecast because no one can really forecast the future and also because the spirit of speculation seems to be spreading so rapidly that it is to be feared the whole nation will soon quit "working for a living" while it wastes its energy and its capital in trying to "get rich quick" by buying something.

The stock brokers' offices are all crowded and the clerks are working over time to keep up with what is undoubtedly the biggest business ever handled in "Wall Street," which is a term that now includes the "Curb Exchange" as well as the older Stock Exchange. The old year closed with a burst of bullish activity that carried many stocks to the highest figures touched since the boom began.

Steel and iron have again moved upward. Copper has sold at 15¼ cents. The other metals are steady. Rubber has touched 40 cents. Lumber is in better demand and the price of wool has been well maintained.

Those who have been doing the buying that has lifted stocks and commodities have had some special reason for their purchases in each case, but it is hardly necessary to go into details as "all signs fail in dry weather" and the prevailing optimism is the only satisfying explanation that can be offered for an upward movement.

As long as this optimism persists the advance is not likely to be interrupted, for it has now acquired an impetus that cannot be easily checked. Early in the week the apparent reluctance of France to recognize the debt she owes the United States looked as if it might prove an unsettling influence and some French bonds declined 2 or 3 per cent, but as this is written the misunderstanding that had arisen appears to have been resolved and the apprehension felt has been dissipated. Money has been higher. On call it has loaned at 5 per cent and on time it is from ¼ to ½ per cent above the lowest figures touched.

Sterling exchange has also continued to improve. At a high of 4.73⅞ it is within 13 points of par and 4.86 by the spring is now confidently predicted in London. Gold exports for December will probably reach $45,000,000 and as much or more is expected to go out in January.

But nothing that suggests reaction or hesitation is now heeded. Those who advise conservatism or caution are ignored or reviled as timid souls who lack faith in the glorious future of the United States, and while those who follow it may be skating on thin ice there is no denying that the year opens with what may be called a boom in the speculative markets and that there is nothing in sight to stop it.

But this is not to say we should relax our vigilance as we scan the horizon for just as the sunshine is certain to follow the rain so we may be sure that the fair weather and smooth seas we are now enjoying will sooner or later be succeeded by a storm.

The question is when? No one can answer it with precision, but those who are prudent will keep a sharp lookout.

What's Doing in Industry

The attention of the machinery and machine tool men has been turned to the builders of automobiles who this month start on an ambitious schedule. The buying of tools is expected to follow and in some cases orders have already been placed. The Nash Motors Co. has placed orders estimated at close to a million dollars for the three plants now operated by this interest. Detroit dealers are preparing for a machine tool demand within the next thirty days and dealers in the East are expecting the accessory makers to be in the market within the next ten days.

While the automobile makers are expected to be very good customers during 1925, the railroads will also buy generously, it is anticipated. Big appropriations have been made by the roads for new equipment and tools will be sold to repair shops, locomotive builders, freight car makers and other allied lines.

With these two sources almost certain of buying more than for years past, with radio builders and the big electric companies planning expansions for the year, and with general industrials looking forward to exceptional business, machinery and machine tool builders are confident of a better year than either 1923 or 1924.

December proved to be the best month of the year in the Middle West and was also a very good month in the East. Southern conditions show improvement and prospects are good as the textile factories of the South are apparently prosperous and have made plans for increased business during the coming year.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

The last week of 1924 passed without any perceptible change of importance in the machine tool situation in Chicago. Confidence in the improved aspect of the future outlook continues, but no special activity is anticipated until January is well advanced.

Inquiries are encouraging, and bear out the forecast of good business to follow shortly after the holiday season. The present week found a general relaxation among those engaged in the machine tool industry, as in practically every other line of business. It is said on good authority that the Western railroad requirements in the way of tools and machinery will not be made known until late in January, or possibly early in February. When these are announced trade conditions will be given an impetus that will be felt in every department of machinery production. That at least is the belief of all forward looking men who take note of developments that are likely to materialize.

It is reported that the Nash Motors Co. and the Ajax Motor Co., are the heaviest buyers of recent months, having placed all the orders needed to complete the new shops. The total amount involved in these orders is believed to have been $1,000,000, or not much less than that amount. The Miehle Printing Press Co. of Chicago has closed orders for a supply of new machinery which include turret lathes, a milling machine of planer type, and 20-inch upright drill. The City of Chicago, through the Board of Education, will shortly be in the market for special machinery, but just what its requirements in this line may be will not be made known for two or three weeks.

New England

That domestic business has increased 10 per cent in the volume actually placed and export business has gained 20 per cent in the last two weeks is the consensus of machine builders of New Haven, Bridgeport and Hartford in the New England section. The percentages employed are the averages given by eleven manufacturers. The experience of manufacturers reporting sales volume in figures of percentage ranged as high as 18 per cent, speaking of domestic business and the best average increase of business closed for export business ranked as much as 29 per cent.

The export business is largely for countries of continental Europe, although some sizeable orders came in from Japan. The buying was of heavy automatic machinery, much of it for railroads and rail equipment industries. The nature of the orders is such as to be convincing of the adoption of American labor-saving machinery equipment in a broader scale.

The domestic trade is classed almost exclusively in three principal lines—railroads, electrical and automotive industries. The railroad buying lead in the volume and automotive business came next in order. The business from the automobile industry was largely of the replacement variety.

Machinery salesmen working out of Hartford, New Haven and Springfield report a good volume of buying of small machinery and an improved amount of hand tool business. Dealers in machinists' tools are now stocking more heavily and the depleted condition of stocks is indicative of further business.

Dealers in used machinery are finding improvement in their lines. This business is largely from automobile repair shops that are being equipped for the handling of bigger work.

Detroit

Very little change has been noted during the past seven-day period in the machinery and machine tool field in Detroit and vicinity.

The suspension of operations on the part of many of the larger firms which are taking their annual inventories, and a noticeable attitude of waiting for the national automobile shows and the annual convention of the Society of Automotive Engineers that will be held in connection with the Detroit automobile show, has not been conducive to much business.

Dealers of machinery are busy preparing for the next few months, however, as motor row is anticipating one of the big years in the history of the automobile business.

There is an apparent desire of many manufacturing plants in other sections to establish branches and in many cases construct factories in Detroit. Inquiries received by the Industrial Bureau of the Detroit Board of Commerce portend a number of new industries for the city.

By the first full week in January production at all the automobile factories will probably be going full blast. Replenishment of dieroom, toolroom, and equipment room supplies on the part of automobile plants has featured the business of the machinery and machine tool men during the past week.

Automobile factories are placing fair orders for sheets and strip steel, some covering only for January and others for February or a full quarter. Parts makers in some cases are increasing operations and ordering steel more freely.

Much significance is attached to the fact that most Detroit plants are entering the new year with a normal supply of raw materials on hand and that they are ready for whatever production may be demanded.

Cleveland

Turn of the year is bringing the long expected actual improvement in machine tool demand among Cleveland manufacturers and distributors. This assertion comes from both large interests and the smaller members of the trade, and is based upon actual business done during the last month of the old year, and the promise of more adequate absorption of equipment on the part of users during the first quarter of the new year.

December, in the opinion of several leaders among the manufacturing element, probably will prove to have been the best month of the year, when figures are compiled. In most instances it went well ahead of the previous December both in number of tools taken up and in dollars and cents, and in not a few instances showed double the amount of business done during November. It is significant that the bulk of this new business was made up of smaller tools going into a wide variety of shops that seek to fill-in in anticipation of a wider and more varied demand for their own production. This applies to all varieties of equipment.

The more substantial business, however, the re-equipment of the larger plants, is yet to come. And this will be heard from early in the new year, it is believed, because of the larger number of inquiries that have been issued during the last four weeks. This business will not be filled, though, until manufacturers have readjusted themselves in the matter of inventory and the like, which is usual with the beginning of the year.

Incidentally, tool interests themselves are taking advantage of this year-end, and are changing their own shops around.

Meanwhile the automatic equipment appears to be the best item on the list at the moment. The good business booked during December is taking this equipment into an unusual number of small and even large plants in the Central and Far West, and to some extent into the New England territory. An equally satisfying feature, from the manufacturer's viewpoint, is the diversity of uses to which this equipment is being put, though it is going largely into nickel and brass work manufacture.

The planer field is another division that shows a brisk change for the better, though here also there is room for a good deal of improvement before it can be said that demand really is good. Plants in this field are working

about 25 per cent of capacity, or at least have been up to the present, and are now beginning to add more operatives, in some instances weekly.

Philadelphia

The business situation so far as machinery and machine tool production is concerned, presents a much better outlook now than it did at the beginning of 1924. This is the conclusion reached by most of the dealers and producers throughout the Philadelphia industrial centers, and reflects generally the business sentiment of men in most industrial lines.

Sales of machinery, tools, iron bars and hardware are better now than they were a month ago. This is the report of the Federal Reserve Bank for the Third District, and is backed by the heads of some of the large manufacturing establishments. However, the conditions generally could be improved, and the improvement is looked for during the early months of 1925.

Production in basic industries continued at about the same level in November as in October, and during the early weeks of December there were further advances in metals. Factory employment in industrial centers showed some gains, but average per capita earnings showed little change. The Federal Reserve report shows that metal manufacturers, blast furnaces and forging plants had a noticeable increase during the last month. Employment at structural iron works and at shipyards fell off from 4 to 5 per cent, the Bank's statement shows. During the last six weeks there has been a marked improvement in the market for steel. The call for pig iron is greater than it was a month ago. There has been some movement in substantial quantities of railroad and track equipment, and some plants have received many inquiries for 1925 requirements.

Many of the products of both iron and steel are quoted at higher figures now than a year ago. Textile mills in the Philadelphia district have increased their output. It is reported that the present volume of orders is sufficient to maintain the current rate of operations for two or three months.

Cincinnati

Machine tool manufacturers in Cincinnati are well pleased with the volume of business that they did during December. The past month has proved to be one of the best of the year and the volume of production has been satisfactory to most plants. Optimistic predictions have been made by local executives who feel that 1925 will prove to be the best year since the boom period during and immediately after the war. The last three months of 1924 were better than any previous quarter during the year and manufacturers are confident that the coming months will be even better. Export business is slightly better and there is reason to believe that the next year will see a considerable improvement in orders from foreign markets.

Railroads are not buying much at present. They are holding off in placing orders until well into January when it is anticipated that good business will be allotted to local machine tool factories by the Eastern transportation lines. In the meantime there are a few small orders for tools being received locally, but they are in small volume. The automobile manufacturers are also buying conservatively, although they are expected to be among the best customers of Cincinnati plants in the coming twelve months. Special machinery is still being built here for a number of concerns throughout the country.

Used machinery dealers report that their sales during December measured up well with any previous month of the year. There has been a healthy demand for small tools. Lathe manufacturers report that their sales have been good while the call for milling machines has been satisfactory. Drills have been in fair demand while several good orders have been reported in the past several weeks by planer factories. Electrical tool manufacturers say that their business has been holding up well and prospects point to continued sales in satisfactory volume in 1925. Woodworking plants have closed a most successful year and today have sufficient orders on hand to insure normal operation for several months.

Southern District

Though tool and equipment sales slowed up a little in the Southern territory during the holiday season, there seems to have been a fair increase in the number of inquiries, that have been considerably better in the past month than they were during the corresponding period of the previous year. If these can be taken as an accurate indication of early 1925 business, the trade should experience three or four months of steady activity that should equal sales the early part of 1924, when business proved to be unusually good.

Inquiries for heavier equipment from the Southern railroads have been very active of late, and this business gives promise of another excellent year during 1925, exceeding even 1924 which was one of the best railroad years in the history of the South, with shop and terminal construction carried out during the year amounting to many millions of dollars. This construction still is quite active throughout the South, having slowed up very little during the winter season, and considerable railroad equipment therefore is being purchased at this time.

Other industrial construction during the past year also proved more active in the South than in a decade or more, with the Birmingham metal trades district alone estimating the total amount of such work carried out there or now in progress as amounting to about $15,000,000. This has resulted in an excellent volume of new business of late, and from present inquiries this business is more than likely to continue good for the next three or four months at least.

The cast iron pipe and fittings industry in the Alabama district has been unusually active during the past five or six weeks, and fairly good equipment sales to this field are reported by the trade.

Road building machinery business is beginning to open up a little, with inquiries being received on a basis that promise the best business during the present year the trade in the South has ever enjoyed, as Southern states have announced road building projects for the year that are generally somewhat in excess of previous records.

Smaller shops and service stations are buying a little, principally in the way of used equipment, and the outlook for the early part of the year is reported fairly good.

A good export business is also in prospect for the year in machinery and railroad equipment, but as long as domestic sales continue active the Southern trade is not making a very strong bid for export business.

Textile factories in the South have been fairly prosperous during the past year and orders from this source are anticipated during the coming year.

Machinery Exports in November

Imports and exports of metal working machinery during November, with revised comparative figures for November, 1923, as compiled by the Department of Commerce, are as follows:

	1924 Value	1923 Value
Lathes	$151,003	$140,620
Boring and drilling machines	75,555	31,218
Planers, shapers and slotters	19,500	34,381
Bending and power presses	64,000	44,672
Gear cutters	65,656	74,728
Milling machines	36,871	57,937
Thread cutting and screw machines	12,672	52,707
Punching and shearing machines	6,961	20,069
Power hammers	12,821	27,813
Rolling machines	9,346	.....
Sharpening and grinding machines	130,381	.....
External grinding machines	.....	55,869
Internal grinding machines	.....	19,034
Other grinding and sharpening machinery	.....	49,220
Chucks for machine tools	28,056	32,455
Reamers, cutters, drills, taps, and other metal-working tools	133,629	209,786
Pneumatic portable tools	85,637	74,661
Foundry and molding equipment	21,626	39,617
Other metal-working machinery and parts of	392,634	339,077
Total	$1,266,348	$1,303,864

Western Electric Has Record Year

Charles C. Du Bois, president of the Western Electric Co., estimates 1924 sales at $300,000,000, compared with $255,177,000 in 1923, the previous high in the company's history.

President Du Bois said:

"This has been our greatest year in orders received and business billed. This volume of business is a reflection of the steadily increasing use of electrical products over the period since the war, in particular the accumulated demand for telephone service. The high total in dollars and cents has been made despite the fact that the prices for most electrical equipment were generally lower during the past year than at any time since the war."

The International Western Electric Co., figures for which are not included in the $300,000,000 total, has had the best year in its history.

Manning, Maxwell & Moore Announce Changes

The following changes have been announced by Manning, Maxwell & Moore, Inc., New York:

Henry I. Knickerbocker has been appointed general office manager, machinery department in the New York office.

Joseph Wainwright, formerly district sales manager at Philadelphia, is appointed Eastern sales manager with headquarters in New York.

D. M. McDowell transferred from the New York office to the Philadelphia office will be acting district sales manager in the Philadelphia district.

W. A. Deems, formerly master mechanic of the Baltimore & Ohio R.R., is appointed sales engineer to cover the Eastern and Southeastern territories.

James W. Barr, formerly with the American Tool Works and the Van-Dyck-Churchill Co., New York, has been engaged as a salesman in the New York district.

Herbert S. Lester, formerly with the Hendey Machine Co., has been engaged as a salesman at the New York office.

C. O. Watson has been added to the sales force at the Buffalo office.

Personals

A. H. INGLE, formerly vice-president of the Consolidated Machine Tool Corporation of America, has been elected president of the corporation.

W. L. DAY, president and general manager of General Motors Truck Corporation has resigned. He is succeeded by OTTO A. STOLL.

A. F. CHAMBERLAIN, formerly with the New York office of the Robbins & Myers Co., has resigned and will become associated with the Harrison S. Colburn Co., 90 West St., New York City.

BENJAMIN HACKER is now the export manager of the Husky Wrench Co., Milwaukee, Wis., with offices at 280 Broadway, New York City.

C. B. STARR has joined the Robert June Engineering Management Organization of 8835 Linwood Ave., Detroit, Mich. He was assistant mechanical engineer with the Duff Manufacturing Co., of Pittsburgh, Pa., and later served in the capacity of sales engineer with the Detroit office of the Wayne Tank & Pump Co.

C. E. BLAKE, of Taunton, Mass., has been named Southern branch manager for the Mason Machine Works Co., of Taunton, with headquarters at Greenville, S. C. The company manufactures textile equipment and machinery. Mr. Blake succeeds Edwin Howard, who resigned recently.

EARLE C. HOWARD, formerly sales manager of the Cadillac Motor Car Co., and with that company from 1906 to 1919, has returned to that organization as an assistant to the president.

PETER E. MARTIN has been elected first vice-president in charge of manufacture of the Ford Motor Co., Detroit, and ERNEST C. KANZIER second vice-president.

HENRY SCHUMAN, who for the past five years has been operating the Michigan Bearings Co., 219 Garfield building, Detroit, has organized the Michigan Replacement Parts Corp., for the purpose of engaging in the replacement parts business in southern Michigan. In conducting its policy of expansion the new corporation has bought out the automotive division of the Harry P. Anderson Co., distributor for Torbensen, Russel and Adams axle parts, as well as four or five lines of universal joints.

J. J. SHANAHAN has resigned as general manager of the E. L. Essley Machinery Co., Chicago, Ill. Mr. Shanahan was with the Essley company for 13 years. He has not announced his plans for the future.

CHARLES B. ROSE, who has for the last 16 years been identified with the Velie Motors Corp., and the Moline Plow Co., in Moline, Ill., has been made vice-president and general manager of the Fageol Motors Co., Kent, Ohio.

GEORGE T. P. KLIX has resigned as chief engineer of the C. R. Wilson Body Co., Detroit, to join the American Body Co., Buffalo. O. J. CROWE who has been associated with the purchasing department of the Wilson Body Co., for the last ten years goes with Mr. Klix as director of purchases for the Buffalo concern.

GEORGE I. DANLEY has been appointed manager of the Eastern sales division of the Danly Machine Specialties, with headquarters at 35 Wilbur Ave., Long Island City, New York. He is being assisted by CHAS. F. SCHONMANN, formerly with the American Can Co. and the E. W. Bliss Co.

HENRY W. DARLING, for more than 30 years treasurer of the General Electric Co., has resigned, and on Jan. 1 was succeeded by R. S. MURRAY, who has been assistant treasurer of the company since 1910. In accepting the resignation of Mr. Darling as treasurer, the board of directors elected him a vice-president with such duties as shall be assigned to him by the president.

H. F. T. ERBAN has been appointed assistant vice-president in charge of manufacturing and engineering of the General Electric Co., Schenectady, N. Y.

Business Items

The business of the Hanson Tap and Gauge Co. has been merged with that of the Hanson-Whitney Machine Co., Hartford, Conn., and the combined interests will be operated under the name of the Hanson-Whitney Machine Co.

The Smith & Woodbury Co., 55 Second St., Portland, Ore., has been appointed distributor for Oregon and southwest Washington by the Chicago Pneumatic Tool Co., New York. Headquarters will be at Portland, Ore.

The Laclede Steel Co. has sold its forging plant in East St. Louis, Ill., to the St. Louis Forging Co., a subsidiary of the Standard Forging Co.

Danly Machine Specialties, Inc., 4911 Lincoln Ave., Chicago, announces the opening of two warehouses and offices at 35 Wilbur Ave., Long Island City, New York, and 1537 Temple Ave., Detroit, respectively.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Road making machinery. Hamburg, Germany. Purchase. Reference No. 12,724.

Cranes, hoisting, traveling, electric operated, and steam derrick cranes. London, England. Agency. Reference No. 12,914.

Machinery and parts. Bordeaux, France. Purchase and agency. Reference No. 12,899.

Machinery for making wire nails, and a nail tumbler and polisher. Ciudad Juarez, Mexico. Purchase. Reference No. 12,870.

Machine tools. Turin. Italy. Purchase. Reference No. 12,829.

Machine tools, especially metal working tools and flexible transmission cables. Turin, Italy. Agency. Reference No. 12,831.

Metal working and wood working machinery. Milan, Italy. Agency. Reference No. 12,832.

Catalogs Wanted

Catalogs wanted from makers of riveting machines that will feed ⅛ x ⅛-in. rivets in 20-gauge sheet metal. Also catalogs from makers of seam electric-welding machines. Address R. C. Shepherd, High Point, N. C.

Forthcoming Meetings

American Society for Steel Treating. Winter Sectional Meeting under the auspices of the Cincinnati chapter. Thursday and Friday, Jan. 15 and 16, in Cincinnati.

Society of Automotive Engineers. Annual Meeting. Detroit, Mich., Jan. 20, 21, 22 and 23. C. F. Clarkson, 29 W. 39th St., New York City.

American Management Association. Annual Convention. Hotel Astor, New York City, Jan. 28, 29 and 30. Headquarters, 20 Vesey St., New York City.

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association. Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers. National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19. C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Steel prices continue to advance with increasing demand. Railroads and the construction industry are taking the bulk of the present tonnage. Reserves are low and considerable buying is in evidence for replenishment of stocks. The principal heavy rolled steel products are selling at $2.10 per 100 lb., Pittsburgh. As low as $2 per 100 lb., however, is frequently heard, applying mainly on exceptionally large tonnages.

Non-Ferrous Metals—With the exception of lead, the principal non-ferrous metals continue to rise in price. Copper and zinc are both up ¼c., tin, 2c. and antimony, 2½c. per lb. in New York warehouses since Dec. 26.

(All prices as of Jan. 2)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	23.77
Southern Ohio No. 2	23.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	30.25
BIRMINGHAM	
No. 2 Foundry	20.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.76
Virginia No. 2	30.17
Basic	24.76
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70	3.89	3.45	3.80
No. 12	2.80	3.94	3.50	3.85
No. 14	2.90	3.99	3.55	3.95
No. 16	3.10	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.45	4.40	4.15	4.30
Nos. 22 and 24	3.50	4.45	4.20	4.35
Nos. 25 and 26	3.55	4.50	4.25	4.40
No. 28	3.60	4.60	4.35	4.50
Galvanized				
Nos. 10 and 11	3.75	4.60	....	4.50
Nos. 12 and 14	3.85	4.70	....	4.60
Nos. 16	4.00	....	....	....
Nos. 17 and 21	4.15	5.00	....	4.90
Nos. 22 and 24	4.30	5.15	3.00	5.05
No. 26	4.45	5.30	4.15	5.20
No. 28	4.75	5.60	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular 10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.75c.; 5/32 to ¼, 7.25c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7¼c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.62½
Tin, 5-ton lots, New York			60.50
Lead (up to carlots), St. Louis	9.35	New York	10.75
Zinc (up to carlots), St. Louis	7.85	New York	8.75

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	19.00	16.00	16.25
Copper sheets, base	22.12½	22.50	22.12½
Copper wire, base	20.12½	21.12½	20.75
Copper bars, base	21.37½	23.00	22.62½
Copper tubing, base	24.50	25.12½	25.75
Brass sheets, base	18.87½	19.50	19.25
Brass tubing, base	23.50	25.25	25.00
Brass rods, base	16.87½	18.62½	18.37½
Brass wire, base	19.37½	20.50	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27 00
Zinc sheets (casks)	11.75	12.00	11 37
Solder (½ and ½), (case lots)	40@41	35.00	33. 50
Babbitt metal (83% tin)	60. 00	66. 00	50.00
Babbitt metal (35% tin)	28. 00	20. 00	28.00
Nickel (ingots) f.o.b. refinery	29. 00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33. 00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52. 00
Hot rolled rods, Grade "A" (base)	50. 00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54. 00
Manganese nickel hot rolled rods "D"—high manganese (base)	57. 00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32. 00	Hot rolled rods (base)	40. 00
Blocks	32. 00	Cold drawn rods (base)	48. 00
Ingots	38. 00	Hot rolled sheets (base)	42. 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.75@13. 00	11 25	12.00
Copper, heavy, and wire	12. 50@12. 75	11 00	11.50@11.75
Copper, light, and bottoms	10.75@11.00	9.75	10 50
Heavy lead	8.00@ 8.25	6.75	8 00
Tea lead	7.00@ 7.25	5.25	6.75
Brass, heavy, yellow	7.75@ 8.00	7.00	8.00@8.25
Brass, heavy, red	9. 75@10.00	9.25	9.75
Brass, light	6.50@ 6.75	6.00	6.75
No. 1 yellow rod turnings	8.25@ 8.50	7.00	8.00
Zinc	4.50@ 4.75	3.75	5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23. 50	$22. 85	$21. 00
"A" Grade:				
IC,	20x28, 112 sheets	19. 00	18. 80	17 00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13. 00	13. 50	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7. 25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 14@0. 21	$0. 19	$0.14@0.16
Cotton waste, colored, per lb.	. 09@ .14½	.18	.09½@.12½
Wiping cloths, 13¼x13¼, per lb	.11@.11½*	36. 00 per M	. 11
Wiping cloths, 13¼x20½, per lb.	....	50. 00 per M	. 11
Sal soda, per 100 lb. keg	2. 25	2. 25	2. 25
Roll sulphur, per 100 lb. keg	3. 60	3. 25	3. 75
Linseed oil, per gal., 5 bbl. lots	1. 17	1. 15	1. 25
Lard cutting oil, 25% lard, per gal.	. 55	. 50	. 32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	60%
Second grade	50–10%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0405	.044
Brass rods	per lb	.1687½	.1637½	.155
Solder (½ and ½)	per lb.	.40@.41	.40@.41	.3375
Cotton waste	per lb.	.14@.21	.14@.21	11@14
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.29	.29	.29
Belting, leather, medium	off list	40–2½%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	45%	45%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4. 86	$5. 84	.....
Emery paper	10. 71	11. 00	$11. 90
Emery cloth	28. 00	31. 12	32. 75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1. 49	1. 24	1. 65
Cloth	3. 38	2. 67	3. 55
Fire clay, per 100 lb. bag	.....	. 65	. 75
Coke, prompt furnace, Connellsville	per net ton		3. 75@4. 00
Coke, prompt foundry, Connellsville	per net ton		5.00@5. 75
White lead, dry or in oil	100 lb. kegs	New York, 15. 75	
Red lead, dry	100 lb. kegs	New York, 15. 75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

	New York	Cleveland	Chicago
Rivets: Button heads, ¾-in., ⅞-in., 1x2-in. to 5-in., per 100 lb.	$3. 75	$3. 50	$3. 50
Cone heads, ditto	3. 85	3. 60	3. 70
Washers, cast iron: ½-in. per 100 lb.	6. 50*	4. 00	3. 75
⅝-in., per 100 lb.	5. 50*	4. 00	3. 75

Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland. Tap bolts with hex. heads are $4.65 per 100 lb. at Chicago.

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 45%; 1⅛ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 35%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 40%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 35%.

Coach and lag screws, 1½x$\frac{7}{16}$in., $2.25 per 100, less 45%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35%.

Bolt ends, 1x12-in., 10c. per lb., less 45%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{7}{16}$-in. and smaller and 65% for ½-in. and larger.
Case hardened, ½x½-in., 6c. each, less 50%.

Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 60%. Same discount for tinned. EXTRA per 100 lb. for 1⅛ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Del., Claymont — Worth Steel Co.—alligator scrap shear.

Ind., Indianapolis—W. J. Holliday Co.—8in. brake, 36 in. shear to cut 22 gauge material.

Mass., Boston — L. Altman, 119 Massachusetts Ave.—miscellaneous tools and equipment for repair and service garage.

Mass., Boston—B. Mullen, 27 Central Sq., East Boston — miscellaneous tools and equipment for extensive repair and service garage.

Mass., Lowell — Pratt & Forrest, Pevy St.—miscellaneous tools and equipment for repair and service garage.

Mass., Roxbury (Boston, P. O.)—Simons & Weiner, 286 Blue Hill Ave.—garage equipment and automobile repair tools.

Mass., South Boston (Boston P. O.)—48 Binford St.—ball bearing drill presses, ½ in. capacity.

Mass., Worcester—Worcester Stamped Metal Co., 9 Hunt St.—additional machinery for Foster St. plant.

Mich., South Lyon — Forged Seamless Tube Co.—machine for bending seamless tubing from ⅜ in. to 3 in.

Mo., Anglum—L. Hammer—combination saw and joiner or saw table.

N. Y., Buffalo—Bas-Hatten Steel, Iron & Plate Works Inc., Elk and Keating St.—machinery for sheet iron fabrication, welding, etc., for proposed addition to present plant.

N. Y., East Buffalo (Buffalo P. O.)—The Delaware, Lackawanna and Western R.R. Co., 90 West St., Hoboken, N. J., C. C. Hubbell, Purch. Agt., machinery and equipment for car repair shop in East Halstead St., here.

N. Y., New York—The New York Central R.R., W. C. Bowers, Mgr. Purchases and Stores, Grand Central Station—squaring shear to cut 73 in., cornice brake, 97 in.

N. Y., Rochester—North East Electric Co., 348 Whitney St.—one 12 in. single spindle Leland Gifford drill press.

O., Canton—United Alloy Steel Co., 1949 Harrison Ave., S. W.—machinery and equipment for metal lumber and galvanizing departments, including metal presses, etc., to replace fire loss.

O., Cleveland — Denning Mfg. Co., 1777 East 87th St.—small shaper.

O., Columbus—Auto Motive Lighting Device Co., 400 Dublin Ave., P. R. Young, Purch. Agent—13 power punch presses, 1 gauge slitter capable of taking strip 20 x 28 in.

O., East Liverpool—Patterson Fdry. & Machine Co.—one open side planer, one 20 in. drill press, one 26 in. back geared drill, one back geared shaper, one 3 ft. and one 6 ft. radial drills, one 8 ft. boring mill, one milling machine, one 18 in. x 10 ft., one 24 in. x 12 ft., one 36 in. x 14 ft., one 48 in. x 14 ft. and one 72 in. x 20 ft. lathes.

Pa., Manheim—The Christiana Machine Co.—one open side planer 6 x 16 ft., one vertical boring mill.

Pa., Pittsburgh — Carnegie Steel Co.—alligator shear.

W. Va., Logan—Guyan Machine Shop—hydraulic wheel press 250 to 300 ton capacity or larger.

Wis., Fond du Lac—H. Proppert & Son Co., Dana Bldg.; foundry equipment, incl. rattlers.

Wis., Kenosha—Simmons Co., 160 Exchange St.; additional metal working machinery, including stamping equipment.

Wis., Ladysmith — Ladysmith Wood Works—J. B. Harstad, Purch. Agt.—one sticker and one mortiser.

Wis., Milwaukee — Vilter Mfg. Co., 935 Clinton Ave., woodworking machinery.

Wis., North Milwaukee — General Woodworking Corp., 39th and Villar Ave.—woodworking machinery for making interior finish.

Ont., Highgate—G. H. Luther—complete equipment for garage and repair shop destroyed by fire.

Ont., Humbertone—F. B. Herron—mill saw, rip saw, planer, edgers, motors, electric power.

Ont., Orvillia—The Ditchburn Boats Ltd., Gravenhurst; wood working equipment, planes, rip and band saws, motors and possibly machine shop equipment.

Opportunities for Future Business

Ala., Birmingham—Continental Gin Co., Title Guarantee Bldg., has awarded the contract for the construction of a 1 story paint shop, 2 and 3 story warehouse, assembly building, 150 x 400 ft. wood working mill, 150 x 300 ft. boiler house and drykiln to H. K. Ferguson Co., 4900 Euclid Ave., Cleveland, O. Estimated cost, includnig equipment, $1,000,000.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Calif., San Diego — Bureau Yards & Docks, Nevy Dept., Wash., D. C., plans construction of shop and storage facilities.

Calif., Los Angeles — C. E. Toberman, 6763 Hollywood Blvd., is having plans prepared for the construction of a 4 story, 31 x 135 ft. shop and loft on Hollywood Blvd. Estimated cost to exceed $150,000. Morgan, Walls & Clements, 1124 Van Nuys Bldg., Archts.

Mass., Lynn—R. T. Pender, 41 Sutton St., taking bids for the construction of a 1 story, 50 x 160 ft. repair and service garage on Washington St. Estimated cost $40,000. Sanborn & Weed, 38 Exchange St., Archts.

N. Y., New York—Bing & Bing, Inc., 119 West 40th St., will build a 7 story, 200 x 215 ft. garage at 109 West 50th St., by day labor. Estimated cost $1,400,000.

O., Canton—T. J. Saltzman and F. Ebersole, Carrolton, plans the construction of a 4 story and basement, garage, on Walnut & 3rd Sts. N. E., estimated cost $150,000.

O., Canton—United Alloy Steel Co., 1949 Harrison Ave. S. W., plans the construction of two 1 story factory buildings to replace fire loss. Estimated cost $100,000.

O., Cleveland—Fanner Mfg. Co., (chaplets), Brookside Park, awarded the contract for the construction of a 1 story, 60x70 ft. factory on Brookside Park. Estimated cost $40,000.

O., Cleveland—France Mfg. Co., (electric supplies), L. E. Franco, Pres., 10360 Berea Rd., is having plans prepared for a 2 story and basement, 58x93 ft. factory at 10360 Berea Rd. Estimated cost $40,000. O. N. Chamberlin, 1222 West Clifton Blvd., Archt.

O., Cleveland—J. N. and L. Galvin, Society for Savings Bldg., awarded the contract for the construction of a 3 story and basement, 69x100 ft. garage, etc. at East 69th St. near Euclid Ave. Estimated cost $100,000. Private plans.

O., Cleveland — Sterling Brass Co., S. Weil, Pres., 9600 St. Catherine St., having plans prepared for the construction of a 2 story and basement, 40 x 125 ft. factory and warehouse building on St. Catherine Ave. Estimated cost $75,000. A. Sogg, 3030 Euclid Ave., Archt.

O., Cleveland—The Teachout Co. (millwork), D. W. Teachout, Pres., 321 Prospect Ave., plans the construction of a 1 and 2 story factory. Estimated cost $150,000. Private plans.

O., Mingo Junction—Carnegie Steel Co., Steubenville, plans the expansion of the mills on Ohio River front, including the construction of 7 new open hearth furnaces, new finishing mills are to be built later. Estimated cost to exceed $5,500,000.

Okla., Sand Springs—Sand Springs Railway Co., is having preliminary plans prepared for the construction of a 1 story, 110 x 260 ft. shop to replace the one destroyed by fire. Estimated cost $200,000. C. O. Tingley, Ch. Engr.

O., Youngstown—Carnegie Steel Co. will take bids about March 1, for the construction of 3 mills on McDonald St. The proposed unit will be band and shape mills to have capacity of 300 to 400 tons of finished rolled steel or at least 100,000 tons annually. Estimated cost $2,000,000.

Pa., Philadelphia — Simplex Valve & Meters Co., 1112 North Broad St. awarded the contract for the construction of a 1 story factory at 68th and Woodland Sts.

Wis., Fond du Lac—H. Poppert & Son Co., Dana Bldg., has awarded the contract for the construction of a 1 story, 62 x 100 ft. foundry on Park Ave. Estimated cost $40,000.

Wis., Kenosha — Simmons Co., 160 Exchange St., will build by day labor a 2 story and basement, 40 x 140 ft. addition to factory. Estimated cost $25,000.

Wis., Milwaukee—Maynard Electric Steel Casting Co., Kilburn Rd., will build by day labor a 2 story, 77 x 100 ft. pattern shop. Estimated cost $50,000. Gurda & Gurda, 448 Mitchell St., Archts. Noted Dec. 18.

Wis., Milwaukee — Vilter Mfg. Co., 935 Clinton Ave., awarded the contract for the construction of a 1 story and basement, 42x150 ft., carpenter shop at Clinton Ave. Estimated cost $25,000.

Ont., Highgate—G. H. Luther plans to rebuild garage and repair shop completely destroyed by fire. Estimated cost $40,000.

Ont., Humbertone—R. B. Herron plans the construction of a saw and planing mill.

Ont., Orillia—The Ditchburn Boats Ltd., Gravenhurst, plans the construction of a 2 story, 40 x 120 ft. boat building plant. Estimated cost $100,000.